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(Mac (2nd generation), 1999 18 The iMac form was driven by its primary component, the 15-inch blown-glass cathode ray tube. 19 The level of translucency in the housing was achieved by mixing light-diffusing particles as part of the polymer composition, rather than by the traditional method of applying texture to the tool. 20 A fanless, convection-cooled architecture unifies the top vents with the handle in a single injection-molded, polished-crystal polycarbonate part. 21 A simple ball-and-socket joint adjusts the screen angle between 0 and 4 degrees. 22 Light-diffusing particles within the resin act as opacifiers, defining the soft translucency of the Snow iMac housing. 23 The Flower Power graphic was fused directly into the polycarbonate shell during the molding process. iBook, 1999 24 Translucent, durable polyurethane was molded over the textured polycarbonate housing. Encapsulated within polycarbonate resin, a die-cast metal core forms the retractable handle. Apple Cinema Display (22-Inch), 1999 26 In contrast to traditional molding practices, a variable-thickness, transparent polycarbonate was molded in a mirror-polished 420HH hardened stainless steel tool. This clear enclosure suspends a steel module that houses the 16:9 aspect ratio LCD. Power Mac G4 Cube, 2000 30 The entire computer is suspended within a clear acrylic enclosure to enable a quiet, convection-cooled architecture. Hot air exhausts from the chimney on the top surface. 33 A deployable handle provides access to the removable core. Cables pass through an opening in the acrylic to connect to the underside of the computer. Apple Pro Mouse, 2000 36 A singular bubble of polycarbonate supports the hand and acts as the button. Click force is adjustable via a rotating dial surrounding the tracking optics. Power Mac G4, 2001 40 The side panel of the back-painted polycarbonate enclosure is completely removable, allowing access to internal components. Variable-thickness polycarbonate eliminates the need for structural ribs in the handles. Titanium PowerBook G4, 2001 43 The size of the product is comparatively efficient given the large 15.2-inch, 16:10 aspect ratio LCD, which occupies approximately 90 percent of the footprint. 44 Formed sheets of .4mm Grade 1 titanium — with its high strengthto-weight ratio — enable a thin, lightweight enclosure. 45 An injection-molded, carbon-filled PC/ABS resin frame is bonded to the Inner titanium enclosure to provide structure and torsional rigidity. IPod, 2001 46 The rear housing Is made from a single sheet of formed and polished 304 stainless steel with laser-

etched graphics. 47 Molding a double shot of white PC/ABS under clear polycarbonate achieved visual depth and provided protection for the display without requiring extra parts. A free-spinning mechanical scroll wheel is surrounded by four transport control buttons. 48 A Delrin handle was used for hand polishing the stainless steel iPod housing against multiple polishing wheels that rotated at 3300 rpm. This process resulted in a mirror finish with an average roughness of only 60 nanometers. IMac G4, 2002 50-51 The hemispherical base is molded in clear polycarbonate, back-painted white, and then finished with a matte hardcoat. A cold-forged 5052-H32 spun aluminum base provides access to memory and the AirPort wireless networking card. 52 The counterbalanced display neck passes through the center of the ventilation system and uses springs and pulleys to offset the effect of gravity, making the display feel weightless. iPod (3rd generation), 2003 59 The capacitive scroll wheel is situated under transport control buttons, which are double-shot injection molded and backlit with a light pipe. PowerBook G4 (12- and 17-Inch), 2003 60-61 Formed 5052 aluminum alloy made a lightweight enclosure possible. The surface of the enclosure is blasted with iron powder and then anodized to a thickness of 12 microns. 62 The footprint of the 12-inch model is informed by the width of its full-size keyboard. 63 The painted silver keys on the 17-inch model are backlit using fiber optics that were laid in a sheet and then coiled Into a bundle with an LED at the end. Holes in the speaker grille were drilled by six drills simultaneously. 64-65 6063 aluminum alloy was extruded to a near net shape, then machined to create the frame. This provides structure for the large 17-inch LCD and helps transfer the load from the clutches in the base all the way up through the display enclosure. 66-67 To counterbalance the 17-inch display and provide fluid opening and closing, the springs and clutch were gun drilled through the center and helically ground. iSight, 2003 69 Perforations in the deep-drawn aluminum enclosure tube were rotary punched and fine-blanked to achieve the maximum amount of open area for ventilation.

Power Mac G5, 2003 70 A fully perforated aluminum core maximizes airflow to cool internal components. 74-75 5052 aluminum was die cut and rolled to form the sidewall with integrated handles. Bosses were welded to the inside of the sidewall to eliminate the need for visible fasteners. Power Mac G5, 2003-2006 76-77 Designed for flexibility over time, the Power Mac G5 interior evolved with each generation to optimize performance, expansion, and efficiency while retaining the same basic exterior structure. Apple Wireless Keyboard, 2003 78-79 The polycarbonate base houses batteries at the rear, providing an ergonomic 6-degree tilt. The full-size, 19mm-pitch keyboard has ABS keys with 3.5mm of travel and laser-marked legends to enable localization for 31 regions. iBook G4 (12-inch), 2003 80 The enclosure houses a 12.1-inch TFT XGA active-matrix LCD, a full-size keyboard, and a trackpad with twofinger scrolling functionality. Batterylevel indicator LEDs are concealed behind a thin layer of polycarbonate. 45W Power Adapter, 2003 82-83 Opaque white polycarbonate shells were ultrasonically welded to create a strong, safe enclosure. Retractable gull wings provide built-in cable management. iPod mini, 2004 84 Dyes were added to the anodizing process of the 6063 aluminum enclosure prior to sealing. The internal components were then assembled in the direction of the extrusion. 85 The capacitive Click Wheel includes Integrated transport controls. iPod In-Ear Headphones and Case, 2004 88-89 Thin, interchangeable, compressionmolded silicone tips form a tight seal, enabling the small directional driver. Cinema Display (20-inch), 2004 90-91 A single sheet of 5052 aluminum was rolled to create the enclosure. The double-shot molded polycarbonate and thermoplastic elastomer end cap was compressed inside the enclosure during assembly to ensure a consistent reveal. 92-93 With its details machined in its flat state, 5052 aluminum was then rolled into the shape of the display foot. This thin foot provides enough strength to support the 20- and 24inch LCDs. iPod (4th generation), 2004 94 iPod aboard Space Shuttle Endeavour. Photo courtesy of NASA. iMac G5 (20-inch), 2004 96-97 The entire computer Is contained within the LCD enclosure. iMac G5 with iSight, 2005 98-99 The hinge concealed behind the back panel allows -5 to 25 degrees of tilt. Text was machined and back-painted from the inside of the panel, with clear shot over the top. 101 Perforations in the anodized 5052 aluminum provide ventilation and act as the stereo speaker grille. The hybrid ABS and

synthetic rubber foot provides stability against vibration by dampening the resonant frequency of the computer itself. 102 Both the bezel and back cover were made from double-shot, injectionmolded parts — clear polycarbonate exterior, white opaque PC/ABS interior. 103 The core side of the iMac bezel tool shows the runner system and ejector blocks. iPod shuffle, 2005 106 A double-shot mold created a seamless five-sided box. This houses solid-state memory, resulting in a product that Is just over 1 cubic inch in volume. No display, an integrated USB connector, and a three-way shuffle switch contribute to the simplicity of the design. iPod nano, 2005 108-109 The smooth finish of the polycarbonate surface was achieved by mirror polishing the tool In a nine-step process — from polishing stone to diamond paste. iPod (5th generation) and Leather Case, 2005 110 A light pull of the ribbon at the top of this formed Italian-leather case reveals the full iPod display. Ill The widescreen 320-by-240-pixel resolution LCD is optimized for photos and video. iPod Hi-Fi, 2006 114 An optical alignment system ensured precise positioning of the speaker grille fabric and the frame. 115 Sealed double-wall enclosure with separate chambers and front-panel Isolation for two 80mm midrange drivers enables a maximum sound pressure level of 108 dB at 1 meter. MacBook (13-inch), 2006 118 The radio-transparent enclosure is made from a glossy polycarbonate outer shell with PC/ABS palm rest and display bezel. Interruptions in the surfaces of the enclosure were minimized through the use of a magnetic, latchless design. 119 A webbed keyboard design creates a more rigid structure around the keys to provide a more stable typing platform. iPod shuffle, 2006 122-123 The enclosure was machined from all five sides for a precise fit and offset of the small components. The mechanism of the integrated clip is concealed within the housing. In-Ear Headphones, 2007 124-125 The PC/ABS case holds different sizes of interchangeable compressionmolded silicone headphone tips. iPhone, 2007 126 The spline on the 5052 aluminum alloy housing for every iPhone was custom fit to the unique shape of each 304 stainless steel bezel. 128 An antenna concept test model wrapped in copper tape to simulate the conductive materials in the final design. 129 The black, radio-transparent plastic antenna window removed to reveal the final antenna layout. 130 The round stainless steel back of the Apple logo was mounted inside the rear housing. The vibration motor was mounted in the upper left corner. 131 The main assembly includes the camera, Faraday cage, logic board, lithium-ion polymer battery, and

antenna. 132-133 Six stages of the process used to create the aluminum housing, including the Initial forming stage, stamping to create the antenna window, logo punching and audio jack tunnel extrusion, CNC machining, bead blasting, and anodizing. 135 iPhone after years of (ab)use. iPhone Headphones, 2007 137 Surfaces in the injection mold cavity are CNC machined Into stainless steel and diamond polished to a mirror finish. The mold slides open to release the finished part cleanly. iMac, 2007 138-139 The 5052 H32 aluminum alloy enclosure was forged, then machined on all six sides to yield crisp, square edges with a high-quality finish. Sodalime cover glass forms a flush surface with the enclosure. 140-141 The keyboard housing was machined from the waste material of the iMac blanking process. iPod nano (3rd generation), 2007 144-145 The front enclosure was cold-forged 5052 aluminum alloy. The rear enclosure is formed and polished 304 stainless steel.

jPod touch, 2007 146-147 The stainless steel rear enclosure was polished, then laser cut to provide precise openings for the antenna. The robust aluminum trim fits flush against the glass without the need for a protective bumper. MacBook Air, 2008 150-151 An integrated battery, 1.8-inch hard drive, and machined top case made it possible to include a full-size keyboard and a 13.2-inch display in a product that was only 0.8 inches thick and weighed just 3 pounds. iPhone 3G, 2008 152-153 The 304 stainless steel bezel and polycarbonate back housing were bonded to create one continuous form. ' 154-155 ’ The display module was hooked into one end of the rear housing, where it electrically connects to the Internal components. Only two screws were then required to secure the other end of the two-part enclosure. ^ 156-157 Four stages of the production process. The back cover was Injection molded with a semi-translucent polycarbonate and machined to accommodate the internal components, then back painted to produce a smooth, glossy, deep exterior finish. Thereafter, a thin layer of aluminum was sputtered onto the surface of the rear housing and the excess material was laser ablated away, leaving only the logo and graphics, 158-159 Four progressive stages In the forging and machining processes, from the raw forging of the 304 stainless steel slug to the final polishing of the bezel. iPod touch (2nd generation), 2008 160-161 To achieve a singular, continuous design, the rear housing was formed with a collapsible core that wraps around toward the front surface. LED Cinema Display (24-inch), 2008 162-163 The internal components are held in place by a steel bracket that was formed with a 200-ton press and bonded to the forged aluminum enclosure. A single pane of soda-lime glass covers the entire front surface of the display. LED Cinema Display (27-inch), 2010 165 The entire 5052 aluminum alloy enclosure was forged as one part and machined to a tolerance that allows It to sit flush with the edges of the front glass. MacBook Pro (13-inch), 2008 168-169 Removable 2.5-inch hard drive and lithium-ion battery enclosure. The flush door reveal was achieved using pairs of neodymium magnets. A twoposition lever mechanically releases the door, freeing it from the attraction of the magnets, to provide access to the battery and hard drive. 170-171 All the parts used to assemble a MacBook Pro. 173 The unibody top case was extruded from a single billet of 6063 aluminum. Both the external form and the Internal details — including structural ribs and bosses for supporting components — were machined

from this one piece of aluminum. iPod shuffle (3rd generation), 2009 174-175 The enclosure was manufactured from both extruded aluminum and forged stainless steel. The metal injectionmolded hinge was welded to a stainless steel clip and lapped to a mirror polish. iMac, 2009 176-177 Bluetooth antennae allow wireless connection and eliminate the need for cables between the iMac and its keyboard, trackpad, and mouse. Magic Mouse, 2009 178-179 A capacitive flex on the underside of the back-painted polycarbonate top case enables Multi-Touch gestures. A door In the pressed aluminum rear housing provides access to two rechargeable AA batteries. MacBook (13-inch), 2009 180 The core of the tool that created the injection-molded top case was made from five independently moving pieces of steel. The core collapsed to create undercuts that allowed the side surfaces to be rolled at a constant wall thickness. 181 The bottom case Is made from thermoplastic elastomer molded over a stamped aluminum sheet. This keeps the notebook stable on a surface without the need for separate rubber feet. iPod nano (5th generation), 2009 182-183 The enclosure was created from an extrusion of machined 6063 aluminum alloy that was polished and anodized. The surface was then polished further to achieve the final surface finish. iPad, 2009 185 The rear enclosure was created by cold and hot forging 5052 aluminum alloy. The logo was machined from radio-transparent ABS to enhance wireless performance. iPhone 4, 2010 186-187 The enclosure Is made of aluminosilicate glass and 304 stainless steel. 188-189 Manufactured using three parts, the forged stainless steel bezel acts as both the major structural element and the antenna. The three parts were held in a fixture to enable machining of the internal details and to establish the datum planes. Datums precisely aligned the parts in a second fixture to ensure consistent antenna performance. The second fixture acted as part of the insert mold tool and held the part while its external surfaces were ground. 190-191 These custom-designed, highperformance tungsten carbide cutting tools were used to manufacture the IPhone 4 bezel. 192-193 Apple co-developed a chemically strengthened aluminosilicate glass for the iPhone 4. Numerous tests were conducted to measure its strength and durability — Including a four-point bend test. iPhone 4 Bumpers, 2010 195 A frame of PC/PBT resin is doubleshot molded with a flexible TPSiV surround. The 304 stainless steel buttons were machined and blasted to align — both cosmetically and physically — with the iPhone buttons. Mac mini, 2010 198-199 Several stages of

machining the top and bottom of the Mac mini unibody enclosure from a single extruded billet of 6063 aluminum. 200-201 A custom-designed T-cutter enabled the removal of the maximum amount of material to ensure that all internal components could fit inside a single unibody enclosure. iPod touch (4th generation), 2010 204-205 The Wi-Fi and Bluetooth antenna was designed to receive and transmit radio signals through the front glass, eliminating the need for a radiotransparent antenna window on the stainless steel back housing. Apple TV (2nd generation), 2010 206 Semi-translucent back-painted polycarbonate provides infrared transparency to receive remote signals without requiring an infrared window. 207 The glossy polycarbonate enclosure was masked on top, then screen printed with a matte ink to reveal the logo. Apple Remote (2nd generation), 2010 208-209 To maintain as much of the solid aluminum extrusion as possible, a custom-designed T-cutter was used to cut a single channel that connects the infrared window, the transport control button cavities, and the battery cavity. MacBook Air (2nd generation), 2010 210-211 Three key technologies enabled the thinness of the enclosure. The display cell and backlight were integrated into the display housing to eliminate parts. Solid-state memory, instead of a mechanical hard drive, increases both performance and robustness. And variable-size battery cells optimize the amount of battery chemistry per square inch. iPad 2, 2011 212 A machined 6063 aluminum alloy unibody design with .6mm glass enabled an 8.8mm-thick enclosure. 213 The machined internal contour of the enclosure allowed more room for three frameless battery packs.

iPad 2 Smart Cover, 2011 214 Magnets in the iPad 2 housing move toward the outside of the enclosure when the Smart Cover is attached, but recess when the cover is detached in order to mitigate flux. 215 Magnets embedded within the polyurethane-covered fiberglass panel at the end of the Smart Cover wake and sleep the display by means of a Hall effect, which senses the presence (or absence) of a magnetic field. 216 Leather Smart Cover after years of use. MacBook Pro (Retina 15-inch), 2012 218-219 The glass of the LCD cell covers the entire front surface of the display enclosure, eliminating the need for cover glass. This makes the product thinner and lighter. 220 A MacBook Pro undergoing a torsion test. 221 To ensure peak performance, the thermal architecture incorporates side vents that take In cool air and route it to custom-designed, asymmetricalfin fans, which operate quietly while still maximizing airflow. MagSafe Power Adapter (2nd generation), 2012 222-223 The extruded 6063 aluminum housing contains a light-pipe LED indicator. Inside are five gold-plated pogo pins concealed within a magnetic stainless steel attraction plate. Apple EarPods, 2012 225 Hundreds of prototype models were tested on more than 600 people to obtain more than 500 measurements. This, combined with additional ergonomic data from more than 10,000 people, contributed to the design of an earpiece defined by the geometry of the ear itself. 228-229 The complex shape of the product required one tool that performed 56 actions on one earpiece alone. Optical measurement systems then precisely aligned the housing and the cap together to achieve tolerances of less than 2 microns between parts — and a comfortable fit In the ear. iPod nano (7th generation), 2012 231 The 6063 aluminum unibody enclosure was double anodized. The first process increased hardness and durability, the second provided the high shine and distinctness of image of the diamond-cut chamfers. iPod touch (5th generation) with loop, 2012 232-233 The CD-finished stainless steel button was machined with a tungsten carbide cutter. The button pops out from the back surface to accommodate the Kevlar-strengthened, polyurethanecovered loop. iMac (27-inch), 2012 234-235 A combination of friction stir welding and machining was used to create a single, seamless joint between the front display "chin” and the rear of the housing. 237 The cover glass was fully laminated to the LED-backlit display in order to reduce reflection. Originally developed to mount battery pouches in the MacBook, an adhesive-foam combination was used to bond

the glass and display to the housing. Additionally, a special tool was manufactured to de-bond the display from the housing to access internal components. iPhone 5s, 2013 239 The Home button Is a thin 0.2mm piece of sapphire crystal surrounded by a stainless steel ring. The capacitance of the ring triggers the Touch ID sensor when it comes into contact with a fingertip. The thinness of the crystal enhances the sensor's ability to read a fingerprint. 241 The shiny chamfers on the edge of the enclosure were anodized using lower voltage to achieve a 7-micron oxide layer that enhances clarity. 242-243 The finish of every chamfered edge on the unibody enclosure was created using a custom-made cutter of monocrystalline diamond that had been brazed to a tungsten carbide shaft and then inserted into a large cutter body of lightweight aluminum. The spindle of the cutter was hand built and hand fitted to maintain precise balance and stability. Each diamond lasted 10,000 cuts and was resharpened and reused five times. iPhone 5s Leather Case, 2013 246-247 Eight steps in the process to form the iPhone 5s Leather Case, including skiving the leather to a thinness of 0.4mm, die-cutting the leather, wrapping the leather around the polycarbonate shell, and inlaying the microfiber lining. iPhone 5c Case, 2013 248 Compression-molded silicone over a nylon insert was inlaid with microfiber, which was then precisely laser cut to align with the openings on the exterior. iPhone 5c, 2013 249 An injection-molded polycarbonate shell conceals a stainless steel structural frame. The logo was pad printed on the back of the enclosure prior to applying a hardcoat, while the text graphics were laser marked through the hardcoat into the polycarbonate resin. iPad mini, 2012 250-251 The entire back housing was lapped to a mirror finish, and the logo shape was then masked. Between the first and second stage of the double-anodizing process, the mask was removed, revealing the logo. 252-253 The five-flute, right-hand helix, tungsten carbide profile cutter used to machine both the flat dome and the spline profile to ensure perfect alignment of the enclosure. iPad mini Smart Cover, 2013 254-255 Both the magnets and the hinge are integrated into the soft polyurethane exterior. Mac Pro, 2013 258-259 A cylindrical, single-fan thermal architecture allows air intake through the bottom vents and exhaust through the top fins, cooling the chips on the logic board as air moves upward. 261 An accelerometer activates backlighting on the I/O ports when the Mac Pro is turned or lifted. Four DIMMs of RAM are accessible via a four-bar linkage. 262-263 The 6063 aluminum housing was robotically

buffed using a fine-particle abrasive compound, bringing the surface roughness down to an average roughness of less than 20 nanometers. The buffing wheels were stitched in Germany using cotton grown and sourced from a single mill in Pakistan. 264-265 Six steps in the process of manufacturing the Mac Pro housing, including impact extrusion of the solid 9-inch 6063 aluminum billet, heat treating and quenching to optimize the grain structure, turning on a lathe using custom cutters, and anodizing. iPhone 6 and iPhone 6 Plus, 2014 269 The machined and lapped stainless steel logo is inserted flush with the back housing and coated with titanium nitride for color, gloss, and hardness. iPad Air 2, 2014 270 The graphics were laser etched with a fiber laser to achieve fine resolution and high contrast. Apple Watch Sport, 2015 274 The 7000 Series aluminum is polished to a mirror finish using a 4-axis forcefeedback wheel, then blasted with zirconia media to create a consistent, satin texture. Anodizing adds a hard, clear aluminum oxide layer to protect the case from scratches and corrosion. 275 The Sport Band's soft, yet durable and highly chemical-resistant fluoroelastomer is compression molded in a process that takes twice as long as typical injection molding but results in a stronger, denser polymer.

Apple Watch, 2015 276 Made from 316L stainless steel cold forged to increase its hardness by 80 percent, the case is machined in a 12-station multi-axis CNC milling machine, then polished to a mirror finish using a custom-designed 4-axis force-feedback wheel. The Milanese Loop is made from coils of .5mmdiameter magnetic stainless steel wire, and each coil is optically aligned and precisely laser welded. 277 The back crystal is made by sintering zirconia in a high-temperature oven. Once the zirconia has cooled, a CNC machine mills complex features using diamond grit cutters. The sapphire lenses are then incorporated, and the entire back is polished to a surface roughness of only 3 nanometers — ensuring seamlessness between the zirconia and the sapphire. The text surrounding the crystal is laser engraved using a picosecond laser. 278 The Taptic Engine is a highly efficient, magnetically stabilized actuator using neodymium magnets, highdensity tungsten alloys, and precision bearings. This actuator creates haptic "taps" informed by analog waveforms finely tuned to produce a range of expressions, from delicate to organic to mechanical. To create the Space Black stainless steel case and Links Bracelet, a multi-layered, diamondlike carbon (DLC) coating Is applied using physical vapor deposition In a high-vacuum process. 279 This prototype development board, used for testing performance and behavior, shows the S1 system in package, back crystal. Digital Crown, and display. 280 The Force Touch sensor is made from several layers of polyimide, copper electrodes, silicone, and adhesive molded into ultra-thin sheets that serve as a capacitor. It senses the deflection of the front crystal relative to the housing and can measure deflections of less than 1 micron. 281 The Digital Crown has an 8-pixel optical sensor that provides 200 discrete positions per rotation. The stainless steel grooves are Individually machined with a .2mm T-cutter, then buffed to remove sharp edges. Fluoroelastomer 0-rings seal the crown from water intrusion. Apple Watch 282-283 Apple grows extremely high-quality, single-crystal sapphire ingots — called boules — over two weeks. The front crystal is sliced from the boule using a diamond-encrusted cutting wire, then cut, ground, polished, and laser ablated to create the final geometry. The result is an incredibly precise, optically clear, scratch-resistant crystal. Apple Watch Edition, 2015 286-287 Custom designed and engineered to preserve its color and hue while making it up to twice as hard as traditionally cast gold, the gold alloy used for the

Apple Watch Edition Is cast into thick ingots, then heat treated and compressed multiple times to yield dense, pore-free billets of incredibly strong 18-karat gold. 288 The Modern Buckle's magnetic clasp contains 24 magnet pieces and seven poles. The clasp closes magnetically and opens when the side buttons are depressed, wedging apart the buckle with mushroom heads to shift the position of the magnets from attraction to repulsion. Apple Watch 1 HERMES, 2015 290-291 This unique partnership comprises leather straps handmade by Hermes artisans in France and an Hermes watch face reinterpreted by Apple designers in California. MacBook, 2015 294 The full-size webbed keyboard has a 19mm pitch and 0.5mm of travel. A butterfly mechanism allows for a stable, responsive key that occupies less vertical space. The Force Touch trackpad incorporates pressure sensors and a Taptic Engine under its capacitive glass surface. 295 Terraced lithium-polymer battery cells and the contoured 6063 aluminum enclosure were developed together in order to maximize battery capacity without compromising the structural integrity of the bottom case. To ensure precise placement, the enclosure and battery cells were photographed using high-speed cameras. iPad Pro and Smart Keyboard, 2015 297 An external layer of woven polyester fabric seals and protects the keys and provides a quiet, controlled feel when pressed. An inner layer of specially designed conductive fabric allows data and power to pass between the Smart Connector and the keyboard and is robust enough to withstand thousands of cycles of folding and unfolding. Embedded magnets ensure precise alignment as the keyboard snaps into each of its operating positions. Apple Pencil, 2015 299 The fine tip of the Apple Pencil works with a re-designed Multi-Touch architecture in the iPad Pro to triangulate its location within a single pixel. A secondary beacon slightly above the tip allows the iPad Pro to calculate the relative angle of the Apple Pencil to the iPad Pro. Simultaneously, the strain gauge measures tip pressure to within 1 gram of resolution.

ABS (Acrylonitrile Butadiene Styrene) A tough, high-flow, impact-resistant thermoplastic polymer that can be molded into thin-wall sections. ABS is commonly used for opaque white injection-molded Apple housings for products, including Apple EarPods. Acrylic (Polymethyl Methacrylate or PMMA) A naturally clear, easily molded thermoplastic polymer that Is used when the extreme strength of polycarbonate is not required. Acrylic was injection molded to form the Power Mac G4 Cube. Actions Parts of an injection mold tool, for instance, that move in conjunction with the main cavity of the tool. Slides are an example of an action in a tool. ALS (Ambient Light Sensors) Sensors that detect changes in ambient light and influence a product's behavior accordingly. They are used in IPhone and Mac desktop and notebook computers to dim the display in low-light situations and reduce power consumption. Aluminosilicate Glass Used on all iPhones, Apple's aluminosilicate glass is chemically strengthened through an ionexchange process. Molten glass is formed into thin sheets using a fusiondraw process. The glass surface is compressed by exchanging smaller sodium ions with larger potassium ions. This process increases strength and decreases the likelihood of the glass breaking on impact. Aluminum Alloys Lightweight, versatile metals that can be rolled, extruded, cast, forged, machined, and finished. Types of Aluminum Alloys; 6063 - Generally used for extrusions. Tightly controlled magnesium-silicon ratio and low iron content achieve a clear, clean anodized layer. The IPod nano 2G and iPhone 6 rear housing are made from 6063 aluminum. 5052 H32 - A high-strength alloy generally used in applications In which a part is formed from a sheet of aluminum. The Power Mac G5 Tower is predominantly made from 5052 H32 aluminum. Anodizing A process used to thicken the naturally occurring oxide on aluminum. The anodized layer — usually around 6 to 12 microns thick — creates a hard, corrosion-resistant surface that protects aluminum housings from scratches and environmental conditions. Anodizing Dye During the anodizing process, dyes can be added to color the pores of the clear oxide layer. These dyes tint the normally clear aluminum oxide layer, giving the product a translucent hue while maintaining the metallic appearance of the underlying aluminum. AR (Anti-Reflective) Coating Applied to transparent materials like glass or sapphire to reduce reflections. Layers of thin films with contrasting refractive indices are deposited on a surface to interfere

with certain wavelengths of light. AR coatings reduce glare on MacBook displays and make them easier to view In bright light. They also reduce glare on the IPhone camera lens. Aspect Ratio The proportional relationship between width and height. Displays are generally represented as having a specific aspect ratio. For example, the iPhone 6s Plus has a display of 1920 by 1080 pixels — a ratio of 16:9. Back Painting The process of applying inks to the underside or inside of a plastic or glass part. Back painting can be used to add color to a clear plastic part (such as the AIrPort Extreme housing), to hide a display edge (like the one on a MacBook), or to create a homogeneous surface (like that of the iPhone 3GS rear housing). Billet A bar of metal before it Is processed into finished parts. Apple extrudes 6063 aluminum alloys into billets that are then machined into parts for iPhone and MacBook housings. Blasting J A finishing method whereby a jet of ^ abrasive material is propelled against J a surface. Blasted surfaces can be either finished parts or tools to P create finished parts. Different sizes and shapes of blasting media are used, depending on the material to be blasted and the desired effect of blasting. Apple used spherically shaped 65-micron zirconia beads to blast the extruded aluminum for the iPod nano (2nd generation). Boss A raised feature on the Inside of a housing (such as a plastic molding or metal casting) used to secure fasteners or support features. Capacitive Sensing A process that senses anything dielectrically different from air. Capacitive sensors, such as the IPhone Multi-Touch sensor, use the natural capacitance of the human body as an input mechanism. Cathode Ray Tube (CRT) A display technology that uses a large, heavy glass vacuum tube containing electron guns to accelerate electron beams onto a phosphorescent screen. Cavity The void Into which material is injected during the molding process. CD Finish A machined finish that makes a surface resemble a compact disc, with concentric grooves reflecting light in a radiating pattern. CNC (Computer Numerical Controlled) Machining A material-removal process whereby tools follow set paths directed by programmed commands from computer-aided design and manufacturing (CAD and CAM) systems. 3-Axis CNC Machining - A part or tool can be moved in X, Y, and Z directions. 5-Axls CNC Machining - A part or tool can be moved in X, Y, Z, and two additional degrees of rotation to enable a tool to approach the part from virtually all sides and angles. Collapsible Core An injection mold core with moving parts that reduce its size, enabling a part with undercuts to be removed from a cavity.

compression Molding A method of making parts by placing material in an open mold cavity. The mold is closed under pressure and held until the material is cured. Compression molding is often used for producing parts made from thermoset materials, such as the silicone tips of the Apple In-Ear Headphones. Convection Cooled A passive method of transferring heat from one place to another using the movement of air or fluids. The Power Mac G4 Cube is intentionally cooled through convection: A chimney effect draws cool air from below the product and exhausts warm air through vents at the top. Core The portion of a mold that goes inside the cavity to form the interior of a hollow part. Counterbalance A weight or force that balances another weight or force. Cover Glass A glass that is either laminated to or placed above a product display, such as those on a MacBook or iPhone. Datum A point from which ail measurements can be taken. The datum can be a plane or a feature that is held constant during an operation, such as machining, to ensure consistent part dimensions. Deep Drawing A process that transforms a flat sheet of metal into a 3D shape. The material is drawn into a forming die using a punch. Deep drawing implies the depth of the part is greater than its diameter. Delrin A commercial name for polyoxymethylene (POM), an engineering thermoplastic that is stiff, low in friction, and dimensionally stable. Delrin is often used for polishing fixtures and for supporting parts during assembly. Diamond Because of their extreme hardness, Industrial diamonds are used for polishing and cutting. Apple uses monocrystalline diamonds to cut chamfers into the iPhone 5 aluminum housing. The sharp, hard, blade-like cutter creates a precise, shiny surface without the need for a secondary polishing process. Die Casting A process for creating 3D parts by forcing molten metal into a mold cavity. Die-cast parts have an imperfect surface finish and are typically only used for internal components in Apple products. Distinctness of Image (DOI) A measure of the optical reflective quality of a surface. A reflective surface can have a low DOI if it has a visible surface texture (commonly called "orange peel"). This texture prevents the surface from reflecting light evenly, and the reflected Image appears unclear. In contrast, a perfectly flat mirror has crisp reflections and perfect DOI. Double Anodizing A process used to create different properties on one anodized aluminum part. This can be achieved by masking prior to anodizing, or by removing material after anodizing and then anodizing the

entire part again. On the iPhone 5 and iPhone 5s, the aluminum enclosure was first anodized, and then material was removed from the chamfered edges and the enclosure was anodized again. This created a clear layer over the shiny chamfers, accentuating the bright surface. Double Shot (or Twin Shot) An injection molding process whereby a first shot forms a portion of the finished part and a second (or additional) shot completes the part. An example of a double shot process can include opening up a cavity to expose additional space for a second polymer to enter. Apple often uses double shot molding to create a part that has both clear and opaque areas or hard and soft zones. Elastomer A generic term for rubber-like materials. Elastomers are polymers that are both viscous and elastic. Extrusion A process used to create parts of a constant cross-sectional profile. In a continuous or semi-continuous process, material is pushed through a die. The extrusion is cut to length and machined to make finished parts, such as those for the iPod shuffle (2nd generation) and the 17-Inch bezel on the PowerBook G4. Faraday Cage An enclosure made from conductive materials that block electrical fields. Used to protect sensitive components from radio frequency interference, the Faraday cage was named for Its Inventor, the English physicist and chemist Michael Faraday. Fasteners Hardware, such as screws or rivets, that mechanically join two or more parts together. Fiber Optics Fine, round glass or plastic fibers that help transport light from one location to another. The interior core of the fiber has a different refractive index than Its exterior, ensuring that light travels along the length and doesn't "spill" out of the sides. Fine Blanking A process for shearing a 2D shape out of a sheet of material. Fine blanking is a more refined method of blanking In which the material is compressed between two plates before the punch is pressed into the die. This compression helps to hold tight tolerances. Flash Excess material remaining on a molded, cast, or forged part at the junction of two parts of a mold. Forging A process of making parts by forcing metal into a die. This process can be done hot or cold and, unlike forming, forging can achieve variable thicknesses. Forging allows internal grains to be continuous throughout the part, resulting in increased strength. Parts can be forged multiple times for more complex geometries or to further Increase strength. The Apple Watch stainless steel housing is an example of a forged part. Forming / Stamping / Pressing Processes for making parts by mechanically deforming flat sheet metal. The sheet is formed without adding or removing material. The stainless steel back housings of early

iPods were formed. Friction Stir Welding A method of joining two parts — most commonly made from aluminum — by locally mixing the materials of the two parts mechanically. The parts are pressed together and a heated probe at the end of a tool is applied to soften the junction. The tool then spins to stir the material of the two parts together. Gel Casting A process used to cast 3D ceramic parts that imparts minimal inherent stresses on the part. A slurry of ceramic powder, water, and monomers is poured into a mold and cast to near net shape. After casting the parts are "green." (See "Green State Machining" below.) They are then sintered to achieve their final size and hardness. The zirconia back crystal of the Apple Watch is gel cast. Green State Machining The process by which unfired (or "green") ceramic parts are machined while they are soft. Once ceramic parts have been sintered, they become extremely hard, making the machining process slower and more difficult. Because green parts shrink after sintering, green-state machining is not as precise as post-sintered machining. Grinding A process of removing material from a surface using an abrasive wheel or tool. Apple uses custom-shaped grinding tools to create precise geometry in hard materials, such as the zirconia back crystal of the Apple Watch and the 304 stainless steel bezel of the iPhone 4. Gun Drilling A method of drilling deep, round, parallel-sided holes. Cutting fluid passes through straight-flute drills, which then cut through the material. The core of the spiral hinge on the MacBook is gun drilled. Hall Effect A phenomenon that allows a sensor to detect the presence (or absence) of a magnetic field. The iPad Smart Cover uses the Hall effect to trigger wake and sleep actions when the cover is open or closed.

Hardcoat A coating that can be applied to a part after molding to optimize certain properties. The rear plastic housing of the iPhone 3GS was hardcoated to increase its scratch resistance. Impact Extrusion A process used to create 3D metal parts that employs a punch to force a slug or billet of material into a die. The material is forced up and around the punch to create a hollow form. The Mac Pro is impact extruded into its tubular form. Injection Molding A process of making parts by injecting material (most commonly polymers, but also metals or ceramics) into a mold. Pellets are heated in a barrel and then forced into a mold cavity, and the material cools and hardens into the shape of the cavity. Insert Molding A process of molding plastic around a second material. Insert molding is generally used to secure threaded metal bosses or to join two parts together more accurately than standard assembly methods can achieve. The separate components of the 304 stainless steel iPhone 4 bezel were inserted into a mold cavity before plastic was injected into the gap, securely joining the parts together. Lapping A process of removing material evenly from the front and/or back surfaces of a part. Parts are placed under or between plates filled with an abrasive slurry. The parts and plates are successively rotated for a set period of time to precisely reduce the thickness of the parts. The iPhone glass and iPhone 5 aluminum housing are lapped. Laser A device that creates a highly directional beam of light by stimulated emission. Laser light differs from ordinary light In that it Is monochromatic (a single wavelength), coherent (aligned), and collimated (parallel). These properties enable a laser beam to be highly focused into a precise area of intense power, which drives unique physical reactions, such as annealing, melting, and vaporization. Lasers offer accurate, reliable methods of machining, marking, and bonding most materials without tools, ink, and hazardous chemicals. Laser Ablating The process of selectively removing material by vaporizing it with highintensity laser light. A laser ablation process is used on the Apple Watch to create recessed text on the back of the stainless steel case. Laser-ablation was also used to drill 30-microndlameter holes for the sleep light on the MacBook Air (1st generation) and the status light on Bluetooth keyboards and trackpads. Laser Cutting A method of cutting that uses a highpowered laser beam on the surface of a material. The material is melted or vaporized by the laser, leaving a clean, precise edge. In some cases, a high-pressure gas stream is

used to blow molten material away from a cut surface. Laser Marking A method of creating a mark through delivery of laser energy to precise locations on the surface of a material. Lasers can alter color locally by changing surface properties through chemical or thermal effects, and they can create contrast by etching a surface to alter its reflectivity. The logo on the rear housing of the iPod nano (1st generation) was achieved through this type of laser marking. Lasers can also be used to mark a material so that there is no disruption to its surface. The black text on the underside of a MacBook was achieved using this type of laser marking. Laser Welding Joining two metals by melting them together through the absorption of a laser beam at the surface. Lasers can be used for many types of welds, including spot welds and seam welds. The edges of the Apple Watch Milanese Loop are laser welded. LCD (Liquid Crystal Display) A type of display that does not emit light directly but instead uses the light-modulating properties of liquid crystal placed between polarizing filters. LED (Light Emitting Diode) Small, illuminating semiconductor devices that efficiently emit visible light when a current is passed through them. Light Pipe A device that transports light from one location to another. Light pipes are often clear or translucent injection-molded plastic. A light source, often an LED, is positioned internally at one end of the pipe, while the other end is visible to the user. Light pipes are used in the control buttons for the iPod (3rd generation). Lithium-Ion Polymer Battery A rechargeable, high-density battery that comes in the form of a soft pouch. These batteries can be produced in a wide variety of shapes, but their soft casings require protection from external housings to prevent damage. Lithium-ion polymer batteries are found in iPhones and Mac notebooks. Magnetic Flux The direction and strength of a magnetic field. The higher the strength of a magnet, the greater its flux. Controlling magnetic flux is important because stray flux can lead to erasure and damage of magnetically enabled objects, such as credit card strips and hard drives. Micron (pm) One micrometer, equal to one millionth of a meter or one thousandth of a millimeter. Monocrystalline Diamond A single-crystal diamond. A chipped crystal results in uneven cutting. Nanometer Equal to one billionth of a meter. The zirconia back crystal of the Apple Watch has a surface roughness of only 3 nanometers. Near Net Shape A step in the process toward creating a finished net-shape part. Forging or extrusion is generally completed to near net shape. More material is removed, often by machining, to create the final

geometry. Working with a near net shape is generally quicker than machining directly from a solid billet of material. Neodymium Magnet A rare-earth magnet made from an alloy of neodymium, iron, and boron. Neodymium magnets are the strongest type of commercially available permanent magnets. The iPad Smart Cover contains neodymium magnets to secure it to the iPad housing. Offset The difference in relative position between two materials, parts, or surfaces. OIS (Optical Inspection Systems) Processes placed on an assembly line to perform various functions. Among other things, Apple has used optical systems to accurately measure the size of holes In components, to check the precision of a surface, or to locate parts on a circuit board. OLED (Organic Light Emitting Diode) A display technology that uses an organic compound to emit light to an electrical current. OLED displays do not require a backlight, so they can be thinner and lighter than LCDs. The Apple Watch uses an OLED display. Oleophobic Coating A thin, transparent coating applied to the cover glass of an iPhone and iPad to prevent oil from fingerprints from transferring to the glass and to make the glass easier to wipe off. The term "oleophobic" refers to materials that repel oil. Parting Line A line on a part corresponding to the edge of a mold opening. PC/ABS (Polycarbonate/Acrylonitrile Butadiene Styrene) A resin generally made from 70 percent ABS and 30 percent PC. PC Increases impact and heat resistance, while ABS provides toughness and good flow. PC/ABS is often used on internal parts and was used for the inner shot of the double-shot injection-molded front housings on early iPod models. PC/PBT (Polycarbonate/Polybutylene Terephthalate) A resin that offers good resistance to chemicals and impact.

I s Plasma Polishing A polishing method in which positively charged metal parts are placed in an electrolytic bath, creating a current that causes the reduction of the surface of a material at a rate of between 2 and 8 microns per minute. Plasma polishing exerts less thermal and mechanical stress on a part. The Apple Watch Milanese Loop mesh is plasma polished. Polishing Slurry A semi-liquid material made up of fluid and small solid particles. The particles remove material from a part in conjunction with a tool or surface. Diamond powder for polishing zirconia or cerium oxide for grinding glass are two examples of particles that may be found In a slurry. Polishing Wheel A wheel of material that is spun against a part to create a buffed or polished surface. Polishing compounds are applied to the wheel to remove material from a surface. Polishing can be done by hand or by using an automated system that includes a force-feedback loop that alters the pressure of the part on a wheel to ensure consistent polish. Polycarbonate A strong, tough thermoplastic polymer. Apple often uses polycarbonate for its transparent, durable qualities. Polycrystalline Diamond Made up of many crystals, polycrystalline diamond has multiple cutting surfaces per particle and is used to Increase tool life or provide better surface finish than can be achieved using carbide tools. Polymer A term often used genetically to refer to plastics. Polymers are molecules made up of many repeating parts. They can either be natural (as in DNA, rubber, and wool) or synthetic (as in acrylic, ABS, and polycarbonate). Polyurethane A polymer that can be either a thermoset or a thermoplastic and has the potential to be a self-skinning, rigid material or a flexible, durable coating. Apple molded a pliant translucent polyurethane over a rigid polycarbonate core to create the handle on the iBook (1st generation). Probe A measuring tool with a hard tip, often made from ruby, used during machining set up to locate a part accurately, set a datum, or define particular dimensions. Profile Bar A technique by which metal is drawn through a die to create a continuous cross section. The stainless steel lugs and links of the Apple Watch Link Bracelet are machined from profile bar. PVD (Physical Vapor Deposition) A method for depositing a thin film of material onto a substrate. Physical vapor depositions rely on a vapor within a vacuum chamber physically striking a surface In order to adhere. The oleophobic coatings on IPhone cover glass, anti-reflective coatings on MacBook displays, and hard coatings on machine tools are all applied using PVD. Radio Transparent

Materials Materials that allow transmission of energy within the radio frequency spectrum. Also called dielectrics, radio- transparent materials include air, glass, ceramics, and certain plastics. Resistance Spot Welding A method of joining two metals through the heat of an electrical current. Multiple spots are often used to increase the strength of the joint. Parts are clamped together, and small welds concentrate the current to a local area to reduce heat distortion on the remainder of the part. Resonant Frequency The natural frequency at which a material vibrates. Reveal The gap between two materials, parts, or surfaces. Rib A thin wall on the inside of plastic or metal parts used to add support to walls or bosses. Robotic Lapping A method of removing material from a part. A robotic arm supports a part against a lapping surface, adjusting the angle, pressure, and direction to remove material precisely. Rotary Punching A process used to create multiple holes in a metal part. Punches on one side of the part are pressed through the material until they make contact with dies on the other side. Rollers allow sequential punching along or around a part. The holes in the ISight camera were rotary punched. Roughness A measure of surface texture. Small variations, often measured In nanometers, are considered polished or mirror polished. Large variations, measured in microns, can be seen on parts, such as the aluminum housing on the iPhone. There are various methods of measuring a surface roughness. Ra (average roughness) is one way of describing the surface made up of peaks and valleys across a part. Sapphire A transparent, crystalline form of aluminum oxide, it is the third-hardest element after diamond and moissanite. Industrial sapphire is grown over many days from a seed to create a single crystal from which parts are cut. Different planes created by the direction of growth produce different properties. The front crystal of the Apple Watch uses parts cut along the A-plane parallel to the direction of crystal growth to achieve the greatest strength. Silicone A thermoset polymer with rubberlike qualities. It can be pliant and chemically resistant, and It does not promote microbial growth. Compression-molded silicone was used to form the tips for the Apple In-Ear Headphones. Slide A part of the mold that moves independently of the main core and cavity. Slides enable the creation of undercuts or details in a part that could not be produced using a simple two-part mold. Soda-Lime Glass The most common commercial glass used for windows and glass containers. It is produced using a float-glass process whereby molten glass is poured onto a molten tin surface inside a furnace to produce a flat,

smooth glass pane. Early iMac cover glass was made of soda-lime glass. Speaker Driver A device that creates sounds waves from electrical energy. A driver is made up of a diaphragm that moves back and forth to create pressure waves. A coil of wires and a permanent magnet create the movement. One or more drivers of different sizes — tweeters, midrange, and woofers, for example — are mounted within various Apple products, from the In-Ear Headphones to the iPod Hi-Fi. Spline A curved line that is defined by a series of control points. Originally, it was a flexible ruler used to draw curves in shipbuilding. The ruler would be fixed at given points and then allowed to flex to create a smooth curve. Computer drawing programs enable a similar process whereby control points can be adjusted to achieve smooth transitions between curves and straight lines. Stainless Steel A steel alloy containing chromium that is therefore more corrosion resistant than regular steel. As a hard, dense material, it can be forged, machined, formed, and polished without the need for additional coatings. Stainless Steel Grades: 304 - A specific alloy that can be forged to a high hardness for good scratch resistance. 304 stainless steel was used to form the bezel on the iPhone 4. 316L - Has excellent corrosion resistance. As sweat can be very corrosive, 316L stainless steel was used to create the housing for the Apple Watch. Taptic Engine A linearly accelerated mass used to create nuanced haptic feedback. Because the mass is not spun on an axle, it can be accelerated, decelerated, started, and stopped quickly, allowing for more precise feedback than a traditional spinning mass.

TFT (Thin Film Transistor) Active Matrix Display A display technology that uses a grid of transistors and capacitors that can hold a charge for a period of time. Each pixel receives and holds the charge, resulting in improved image quality over a regular passive matrix. Thermoplastic A type of polymer that can be melted and remelted into shape. Injectionmolded ABS, used in the housing of the Apple EarPods, is an example of a thermoplastic. Thermoset A type of polymer that cannot be remelted. It is usually cured through heat or a chemical reaction. The compression-molded FKM fluoroelastomer used in the Apple Watch Sport Band is an example of a thermoset. Titanium Tough, high-strength metal alloys that are light and very corrosion resistant. Titanium was used on the PowerBook G4 to achieve a thin, light enclosure. Titanium Carbide A composite material of titanium and carbon. It is extremely hard and stiff, yet lighter than tungsten carbide. Its lightness makes it ideal for use in high-speed cutting tools. TPE (Thermoplastic Elastomers) Pliant thermoplastics exhibiting rubber-like qualities. TPSiV A blend of thermoplastic urethane and a cross-linked silicone rubber. Tough and abrasion resistant but also soft to the touch, this thermoplastic elastomer is used in the iPhone 4 Bumpers. Ultrasonic Welding A method of joining materials, such as plastics, that uses high-frequency, ultrasonic acoustic vibrations. Parts are held together under pressure, and the ultrasonic energy melts the contact point between the parts, creating the joint. , . Undercut In a mold tool, undercut is the geometry that returns on itself so that a single action core cannot be removed. In machining, undercut refers to a recess that cannot be machined with conventional cutting tools. Apple uses T-cutters to machine recessed features in products like the aluminum Apple Remote. Unibody The construction of an enclosure as a predominately singular form. Vibration Motor An eccentric rotating mass that spins rapidly to create vibration for haptics and audible alerts. Webbed Keyboard A keyboard in which individual keys protrude through holes in a flat surface. The continuous surface creates webs between the keys and acts to maintain the structure of the enclosure. The MacBook (2nd generation) uses a webbed keyboard. Zirconia (Zirconium Dioxide) The white crystalline oxide of zirconium metal. Zirconia is strong and extremely hard. The back crystal of the Apple Watch is made from a yttriatoughened zirconia. Designed by Apple in California Tungsten

Carbide A chemical compound made up of carbon and tungsten. Objects made from tungsten carbide are extremely dense, hard, and stiff. Cutting tools are often made from sintered tungsten carbide.

Introduction by Jony Ive This is a book with very few words. It is about our products, their physical nature, and how they were made. While this is a design book, it is not about the design team, the creative process, or product development. It is an objective representation of our work that, ironically, describes who we are. It describes how we work, our values, our preoccupations, and our goals. We have always hoped to be defined by what we do rather than by what we say. The actual products are, of course, incontrovertible. We have attempted to develop an approach to representing them that is equally impartial. The photography is analytical and spare, free from personal voice and its consequent subjectivity. We begin this archive with the translucent iMac of 1998, and we conclude with the Apple Pencil of 2015. We have not included all our work in the interim, only those products that seem significant, that demonstrate learning, or for which we simply have affection. The decision to stop somewhere, to not include our current work, and to not reveal the design of future products was fantastically hard. Many of us have worked with one another for more than 20 years, and we have learned a lot together. The products in this book are the result of a profoundly close collaboration between many different groups. We behave as one team with a singular goal; how we work enables what we make. Designing and making are inseparable. Seeing something made, you appreciate its nature. Understanding the remarkable transformation of anonymous materials into recognizable products, you begin to understand that we don't arbitrarily create form. Fundamental ideas and shapes are derived directly from our knowledge of materials and manufacturing processes: bending a single piece of aluminum to make a stand or cutting a hole to create a handle rather than adding multiple parts. We attempt to develop forms that achieve an integrity between external surfaces and internal components. Look at the first iMac, on page 19. So much of the form was developed to be coherent and harmonious with the primary internal component, the cathode ray tube. You can see how forms and materials have evolved, driven by display technologies and components, as we transitioned from spherical cathode ray tubes to flat-panel liquid crystal displays. We strive, with varying degrees of success, to define objects that appear effortless. Objects that appear so simple, coherent, and inevitable that there could be no rational alternative. Although we have been doing this for many years, creating something simple never

seems to get any easier. Simplicity is not the absence of complexity. Just removing clutter would result in an uncomplicated but meaningless product. I think a product that is truly simple somehow communicates, with striking clarity, what it is and what it can do. Above all, I have come to feel sure that human beings sense care in the same way we sense carelessness. I do think we respond, maybe not consciously, to something much bigger than the object. We sense the group of people behind the products, people who do more than make something work, people who sincerely care about the smallest unseen details, as well as the big idea and primary function.

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For us, these products and projects have come to mark the passage of time. We cannot look at this archive without remembering the people and stories so essential to each product's creation. 1 cannot look at it without thinking of Steve Jobs. This book is dedicated to him. This is a body of work that would not exist without Steve. The many thousands of people who worked together would never have worked together. These products would never have been designed, never have been made, never have been used. The idea of genuinely trying to make something great for humanity, to make a contribution to culture and to our community, has not been a sentimental afterthought. It has been our fundamental motivation, ideal, and goal. We hope that this archive is seen as intended: a gentle gathering of some of the products we have designed over the last few years. We hope it brings some understanding to how and why they exist.

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254 iPad mini Smart Cover
256 iPad Air Smart Case
258 Mac Pro
266 iPhone 6
267 iPhone 6 Plus
270 iPad Air 2
273 Apple Watch
274 Apple Watch Sport
284 Apple Watch Edition
290 Apple Watch | HERMÈS
293 MacBook
297 iPad Pro with Smart Keyboard
299 Apple Pencil

Chronology 1998 iMac 1999 iMac iBook Apple Cinema Display 2000 Power Mac G4 Cube Apple Cube Speakers Apple Pro Mouse iSub 2000 Subwoofer 2001 Power Mac G4 Titanium PowerBook G4 iPod 2002 Apple Cinema HD Display Apple Pro Mouse iMac G4 eMac 2003 iPod PowerBook G4 iSight Power Mac G5 Apple Wireless Keyboard iBook G4 45W Power Adapter 2004 iPod mini Apple In-Ear headphones Cinema Display iPod iMac G5 iPod Sock 2005 iMac G5 iPod shuffle iPod nano iPod 2006 iPod Hi-Fi MacBook iPod nano iPod shuffle 2007 In-Ear Headphones iPhone iPhone Headphones iMac Apple Keyboard iPod nano iPod touch iPod classic 2008 MacBook Air iPhone 3G iPod touch LED Cinema Display MacBook Pro 2009 iPod shuffle IMac Magic Mouse MacBook iPod nano 2010 LED Cinema Display IPad iPhone 4 iPhone 4 Bumpers Mac mini iPod nano iPod shuffle IPod touch Apple TV Apple Remote MacBook Air 2011 iPad 2 iPad 2 Smart Cover 2012 MacBook Pro MagSafe Power Adapter Apple EarPods iPod nano iPod touch iMac iPad mini IPad mini Smart Cover 2013 iPhone 5s iPhone 5s Leather Case iPhone 5c Case iPhone 5c iPad Air Smart Case Mac Pro 2014 iPhone 6 iPhone 6 Plus iPad Air 2 2015 Apple Watch Apple Watch Sport Apple Watch Edition Apple Watch | HERMES MacBook IPad Pro with Smart Keyboard Apple Pencil

iMac, 1998

iMac, 1999 16

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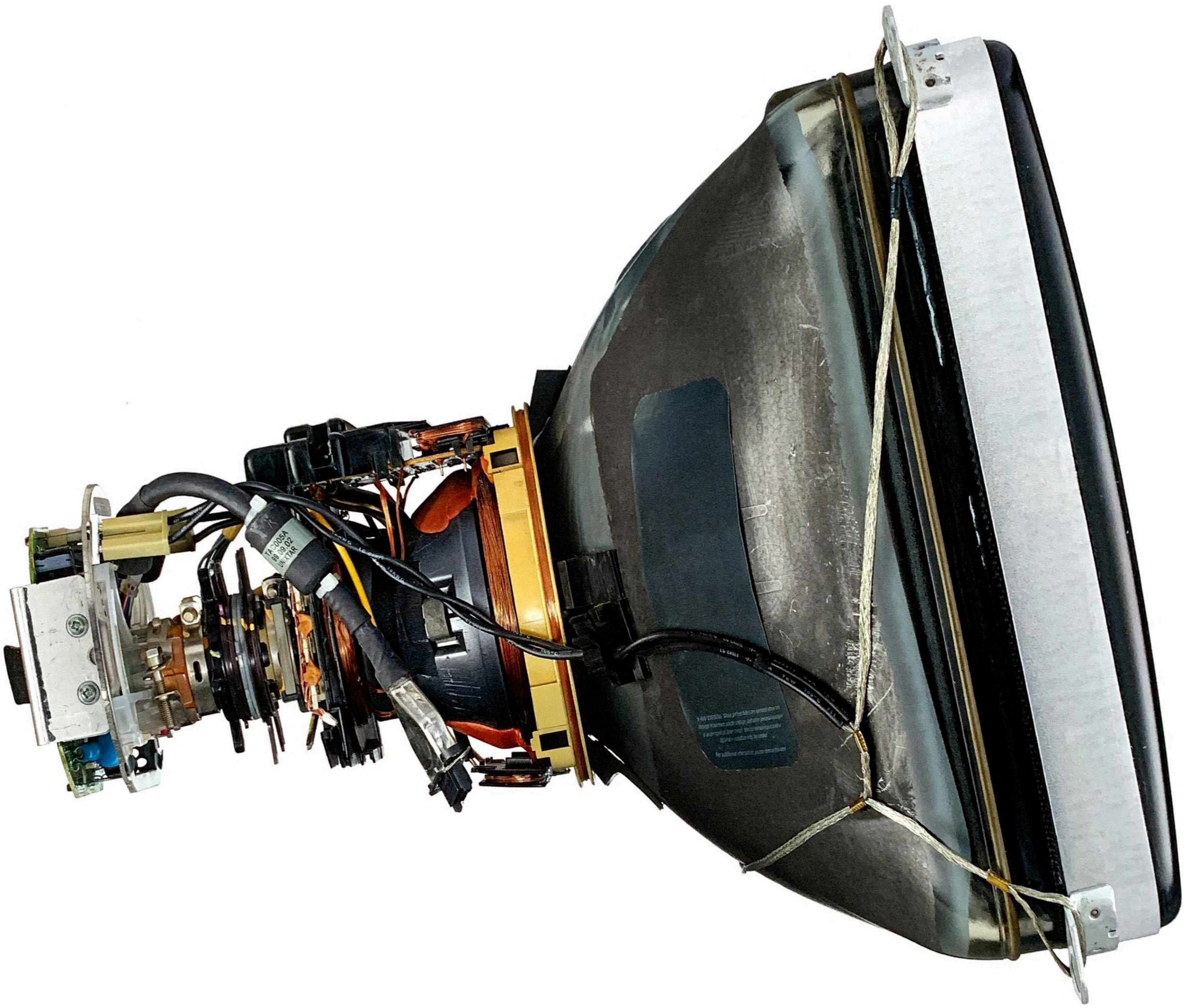

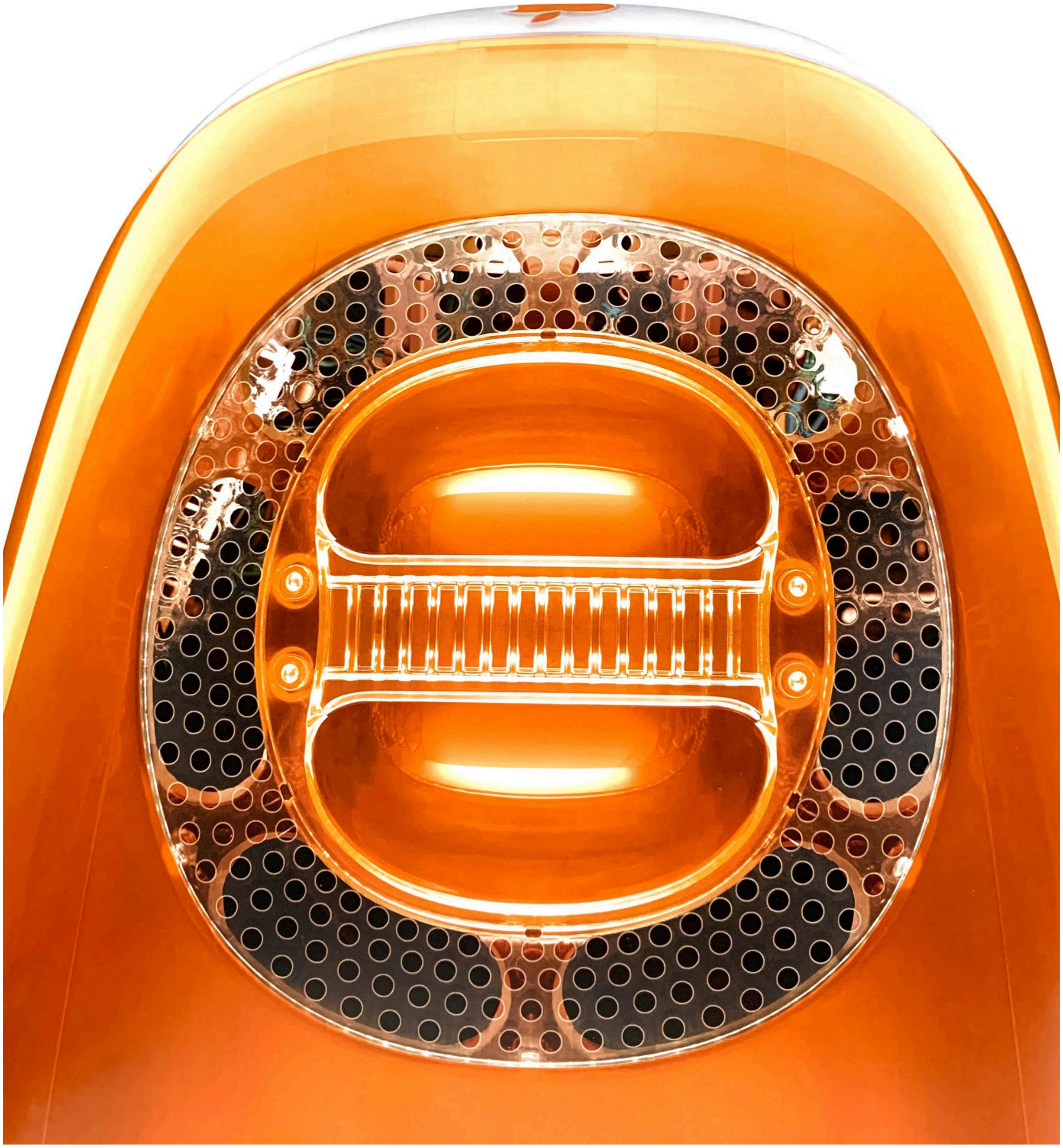

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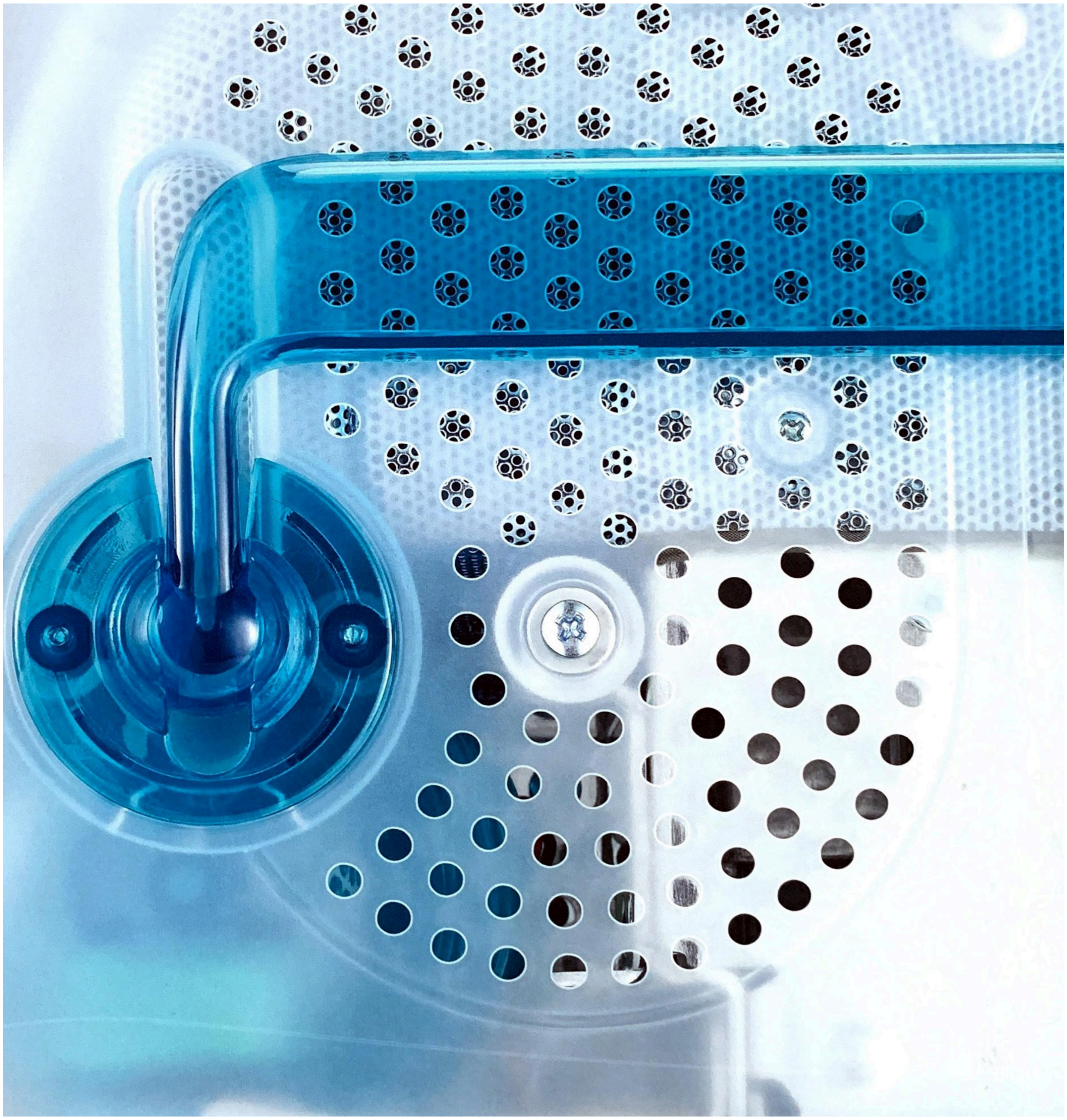

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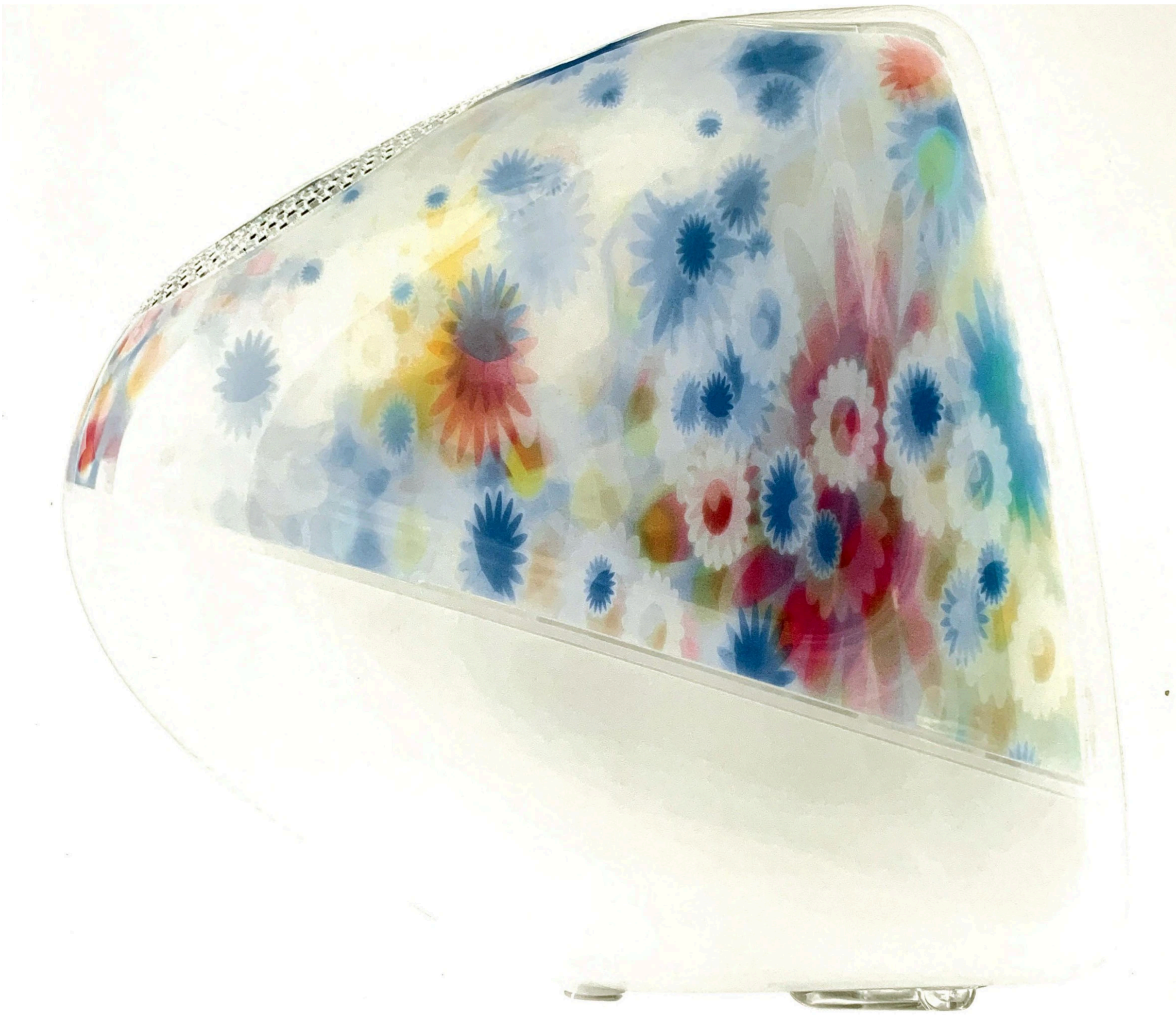
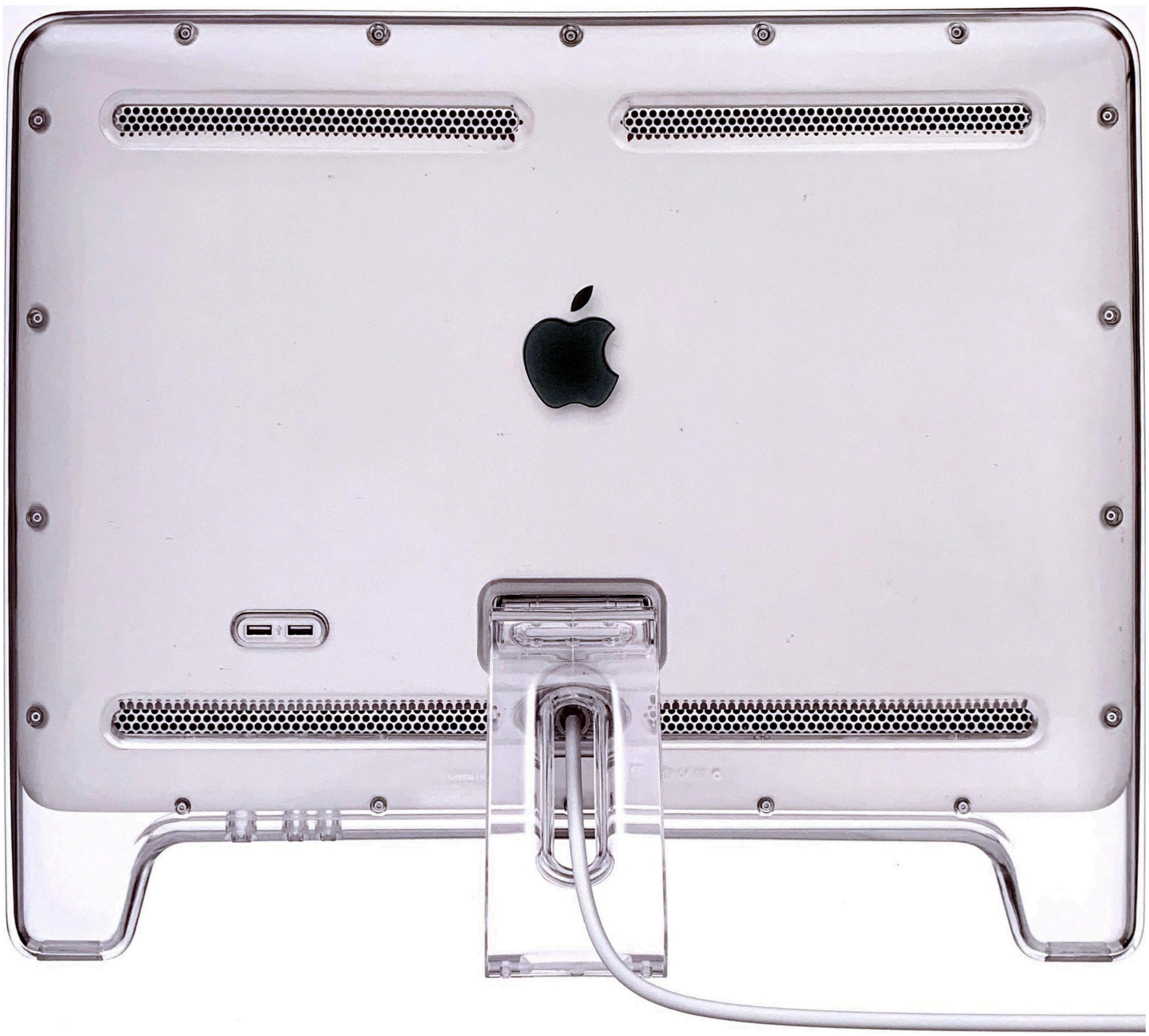


Ijwas Assembled in Taiwan; I Apple Computer. Inc. Cupertino. California 95014

Apple Cinema Display, 1999 26



Apple Cinema HD Display, 2002 28


Cinema HD Display

Power Mac G4 Cube, 2000 30

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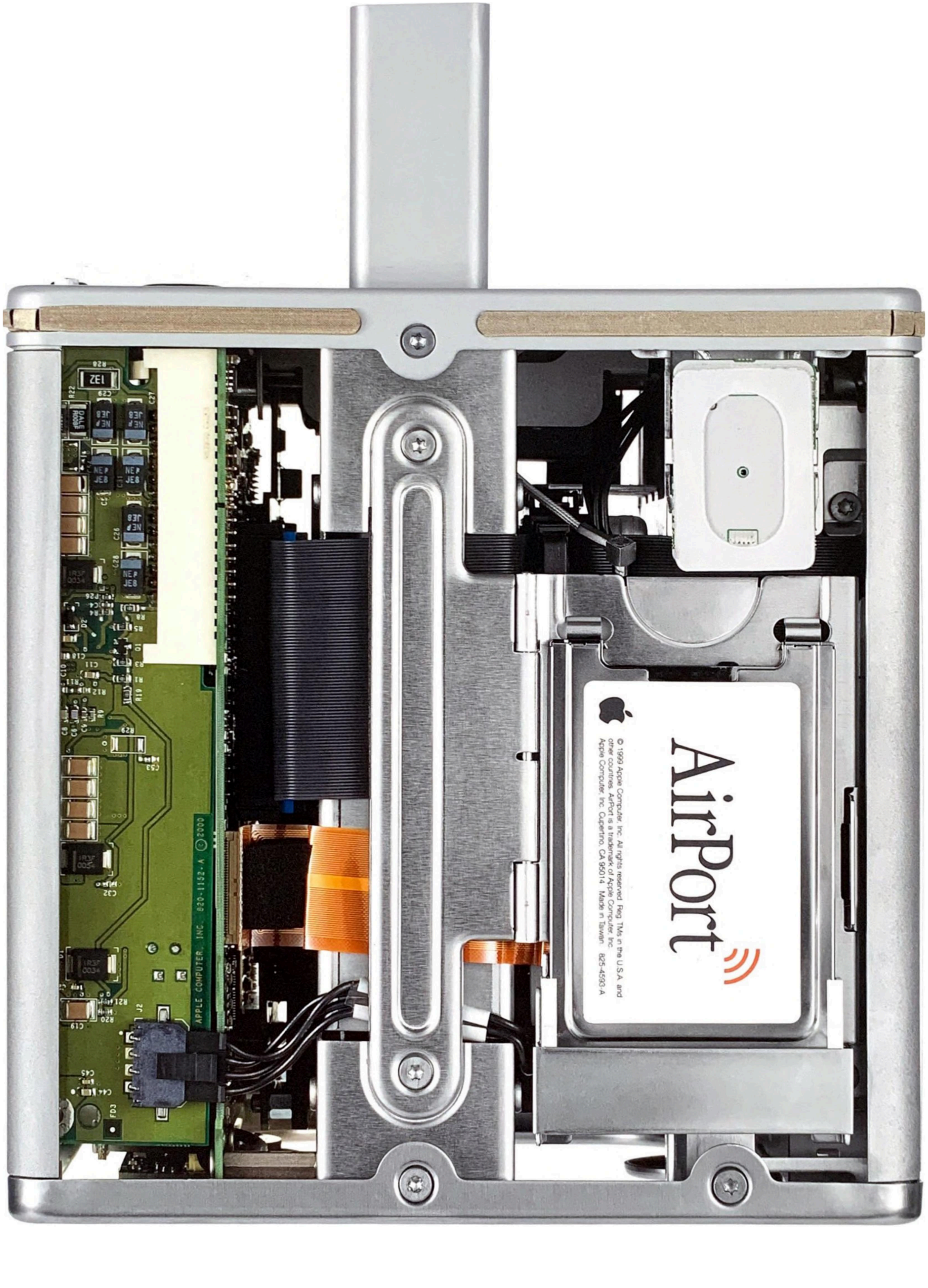
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Apple Cube Speakers, 2000 34

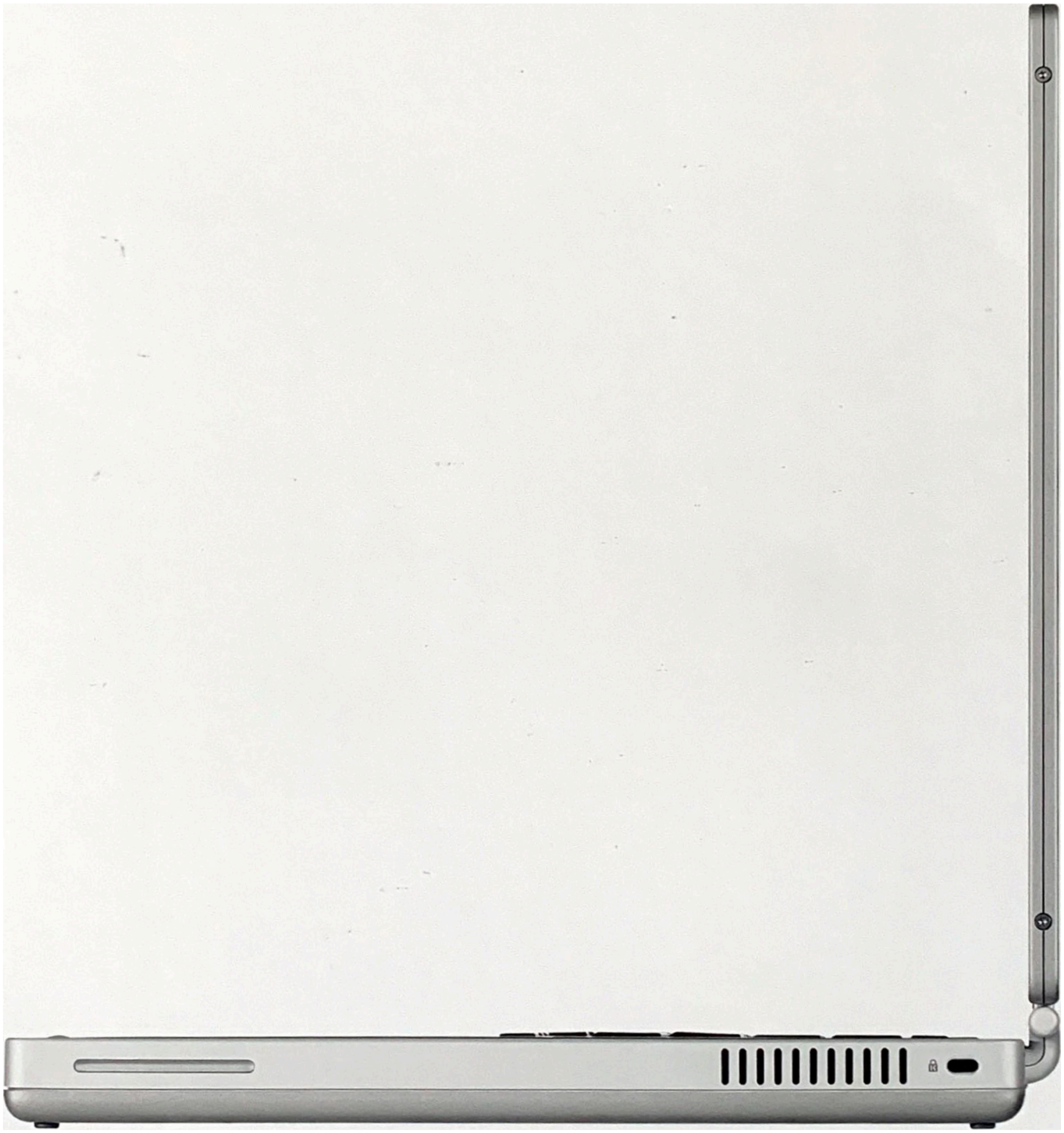
Apple Pro Mouse, 2000 36

Apple Pro Mouse, 2002 37

iSub 2000 Subwoofer, 2000 39

Power Mac G4, 2001 40

PowerBook G4, 2001




PowerBook G4

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iPod, 2001 46


iPod
Serial No GQ302057NAM
Designed by Apple in California Assembled in Taiwan
Model No M8541 EMC No.: 1910 Rated 8-30Vdc 0.5A Max
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FOR HOME OR OFFICE USE
CE
VCI

menu

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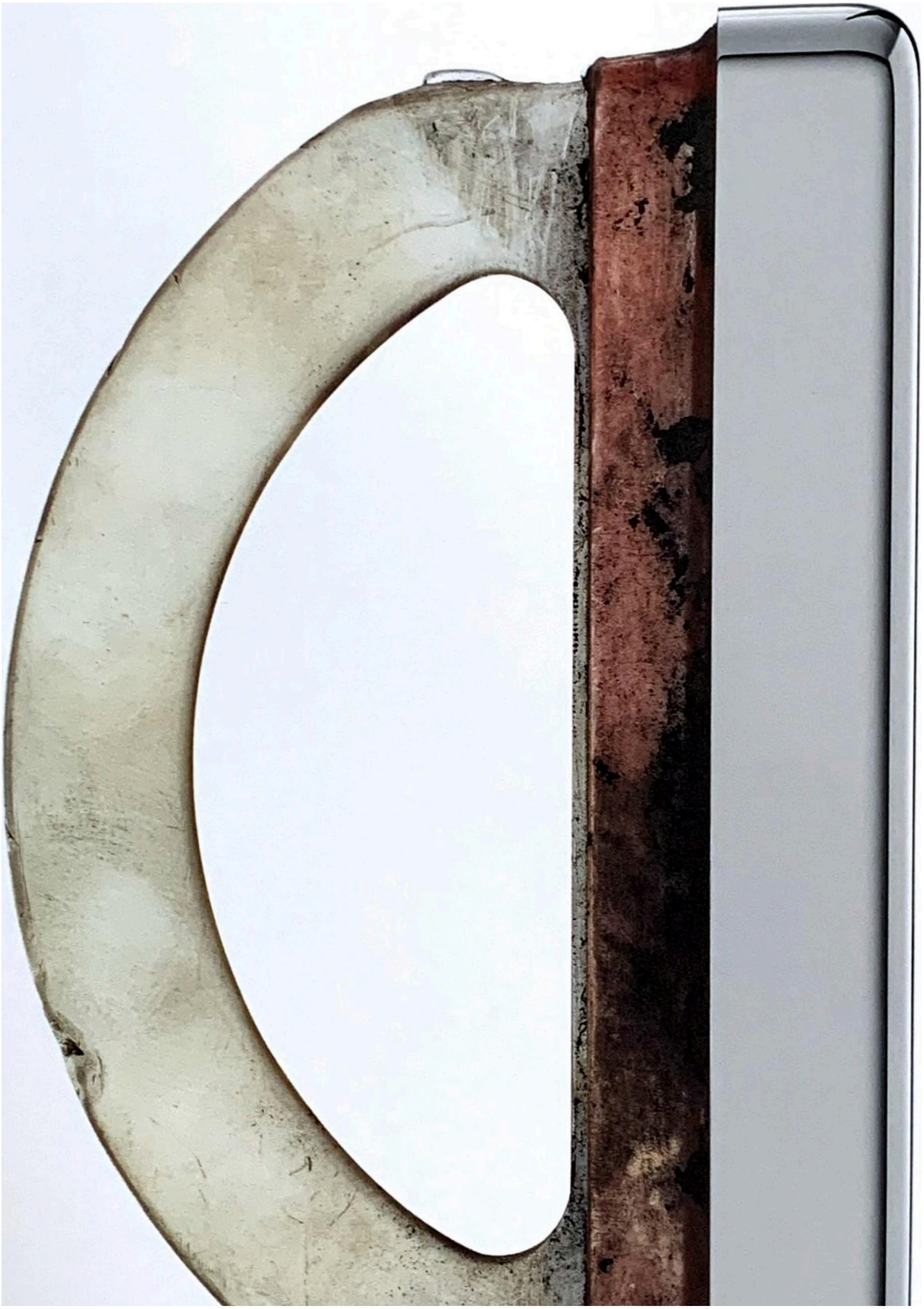
48



iMac G4. 2002 50


iMac

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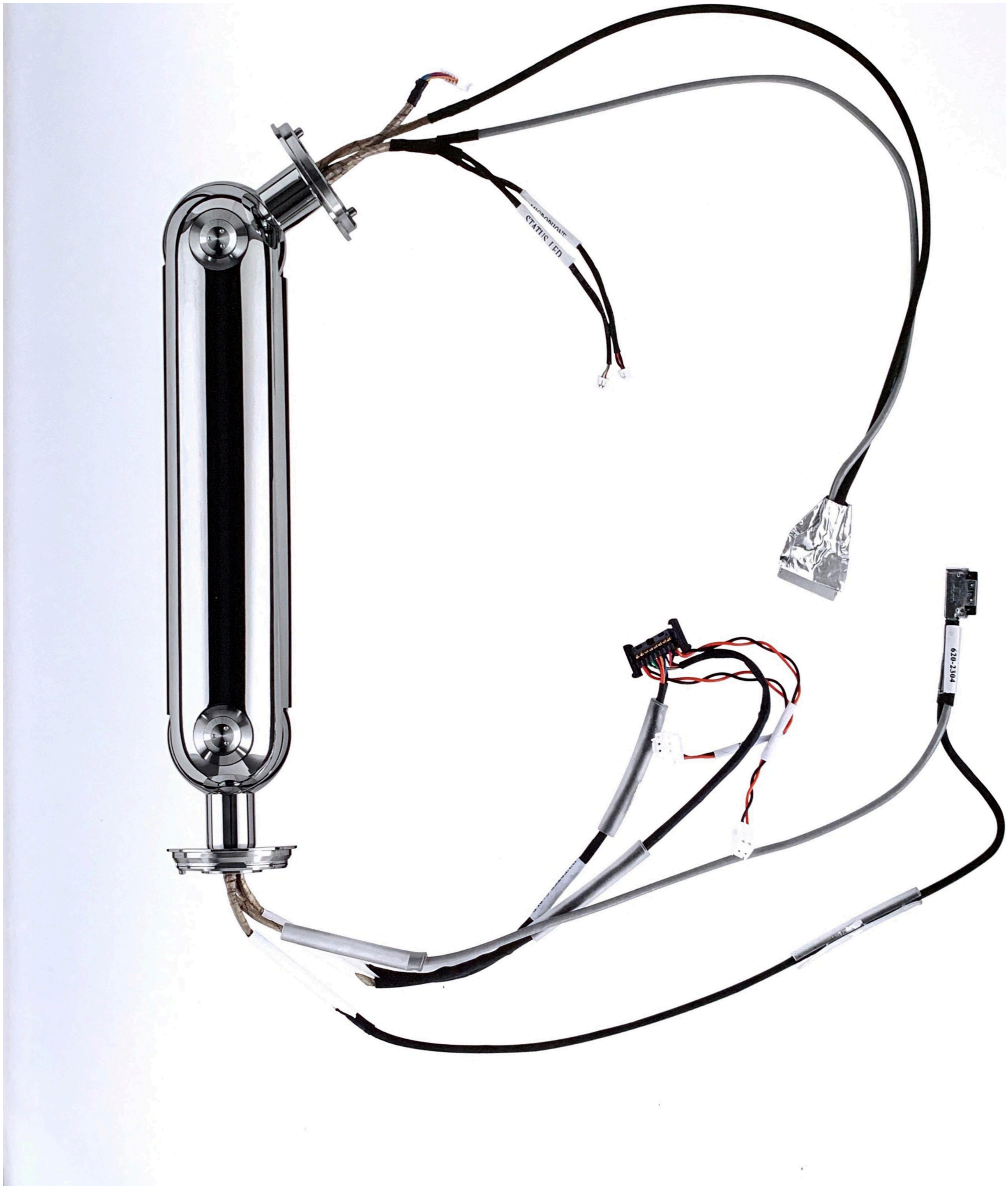
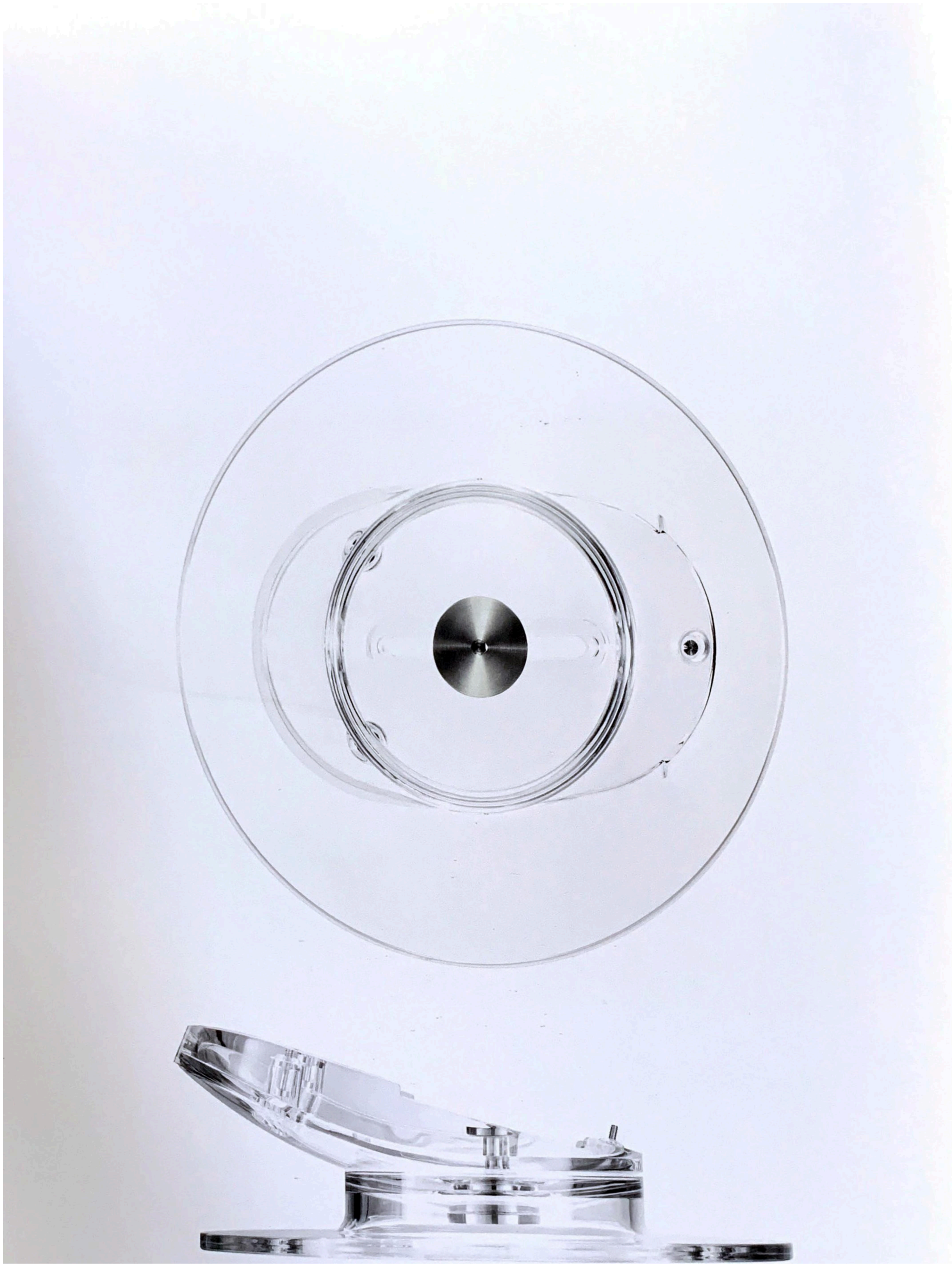

STATUS LED
620-2304

eMac, 2002 55



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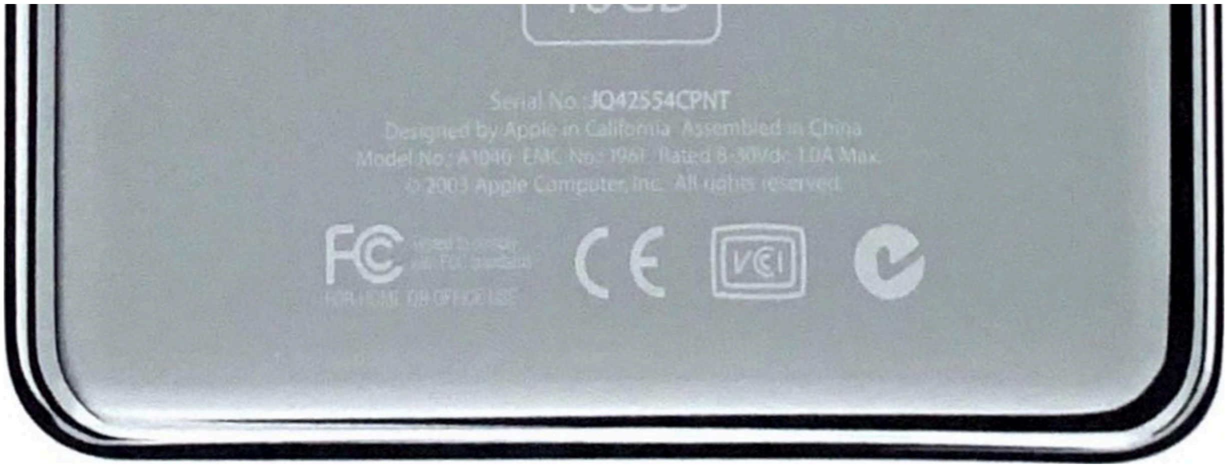
iPod, 2003 58


iPod
40GB


Serial No. JQ42554CPNT
Designed by Apple in California Assembled in China
Model No.: A1040 EMC No.: 1961 Rated 8-30Vdc 1.0A Max.
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MENU


esc F1 F2 F3 F4 F5 num lock F6 F7 F8 F9 F10 F11 F12
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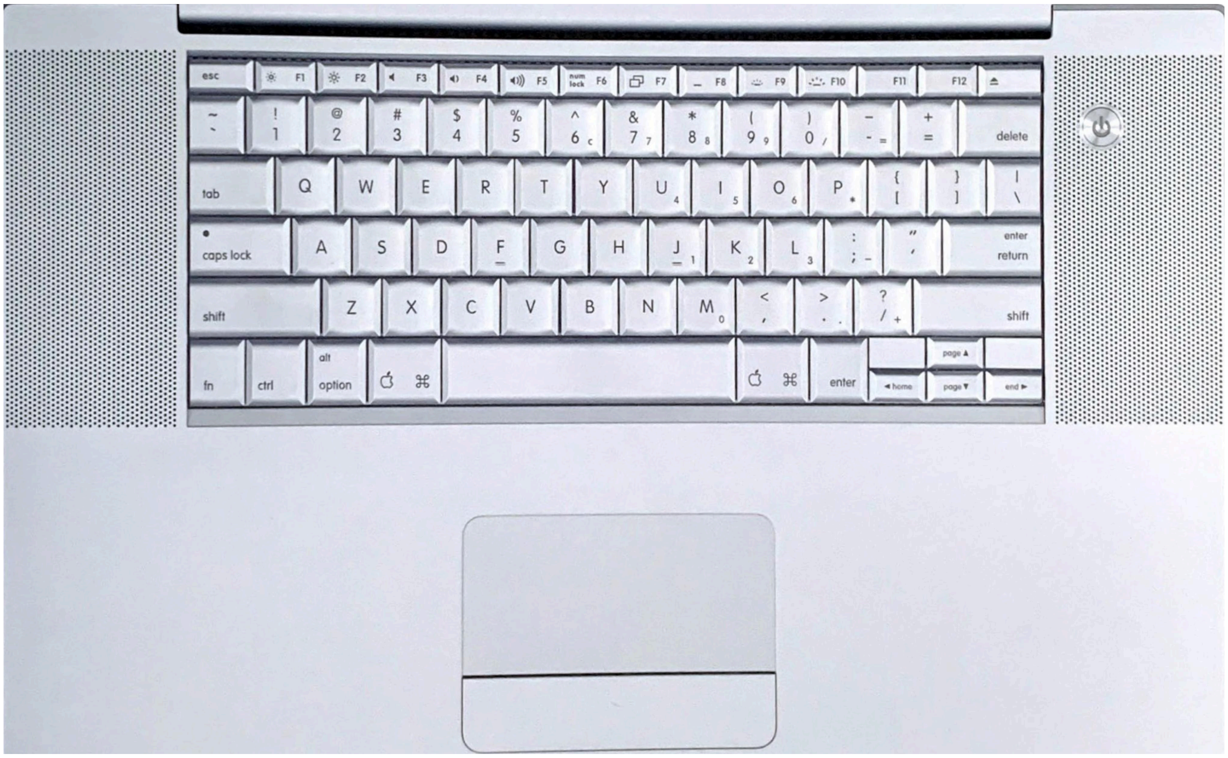
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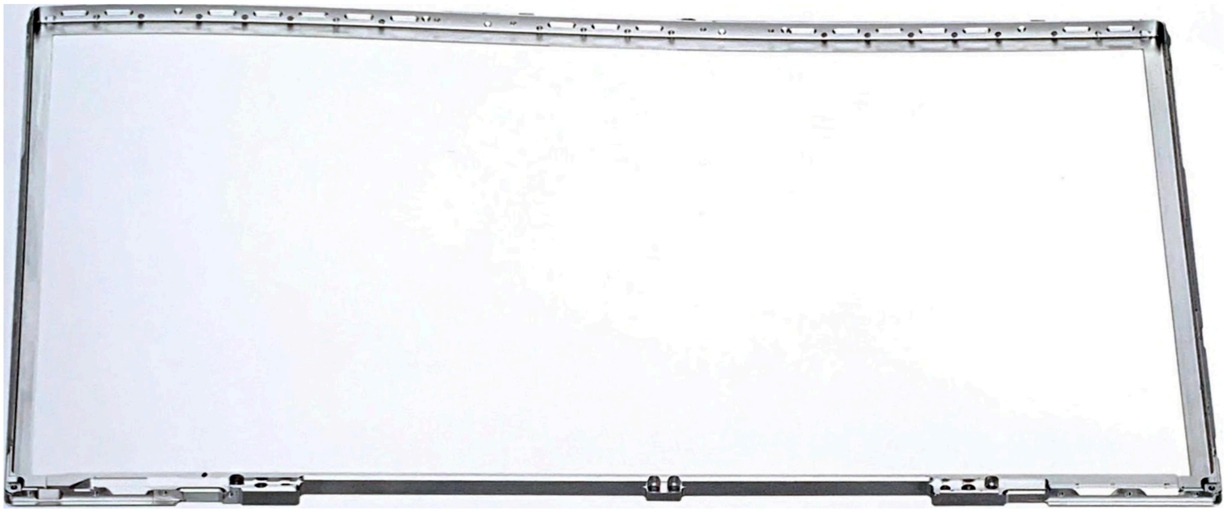

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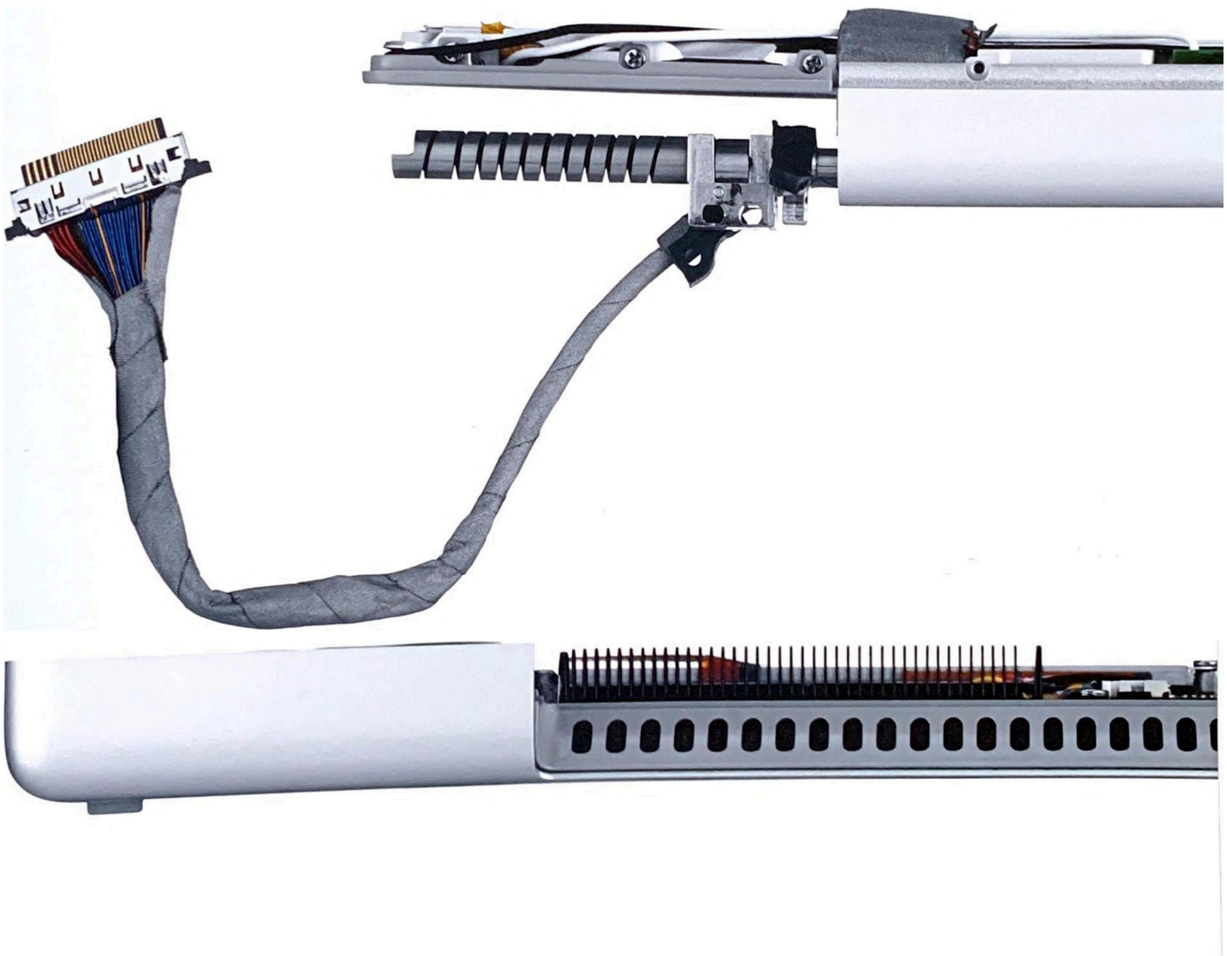
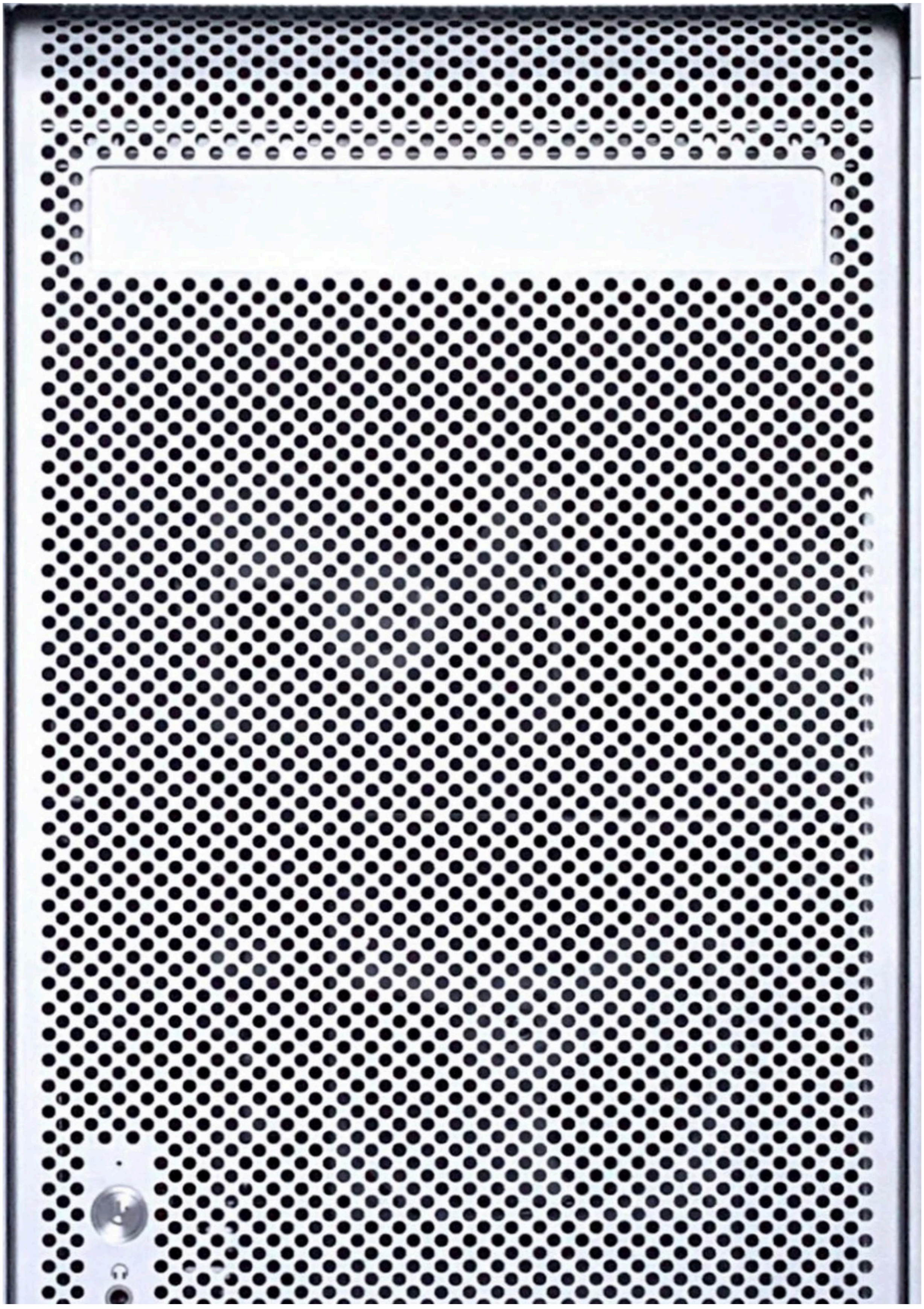
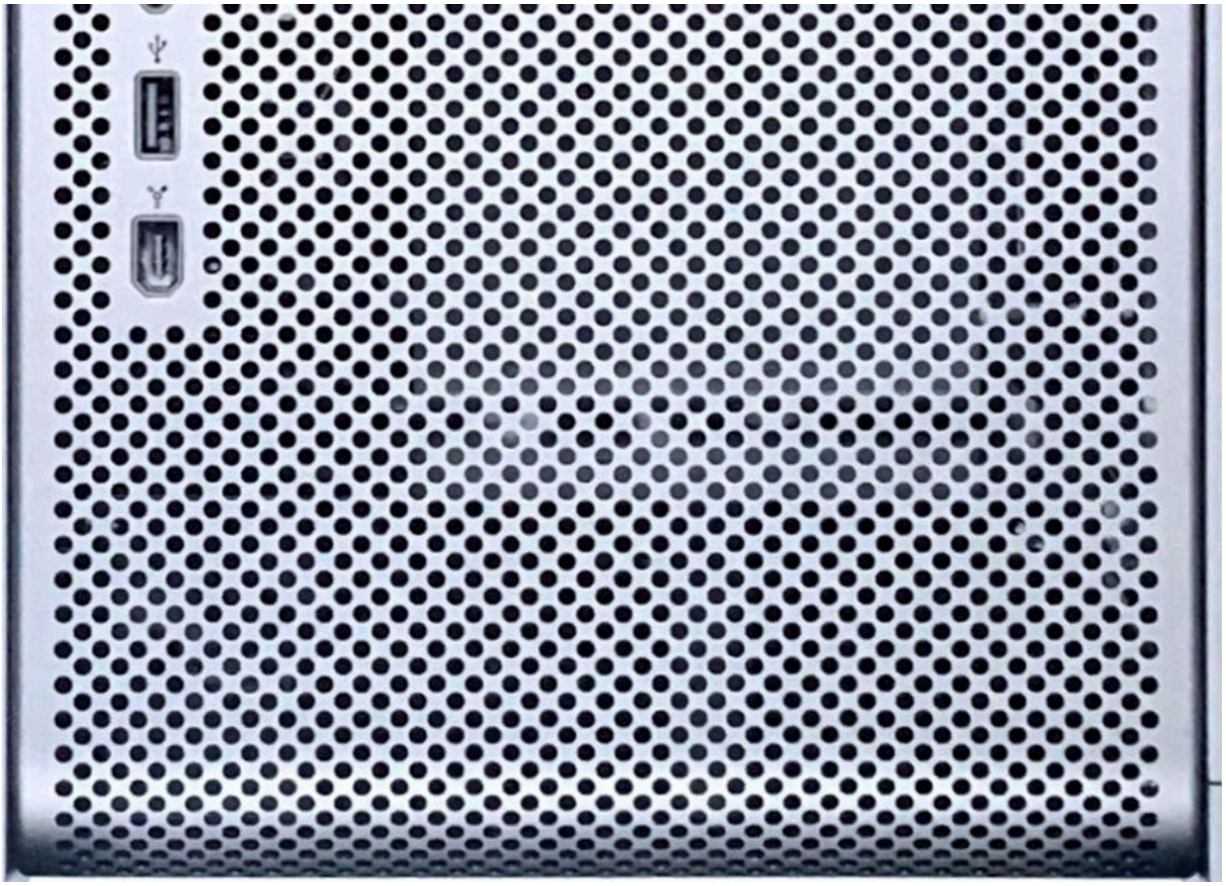


Power Mac G5, 2003 70





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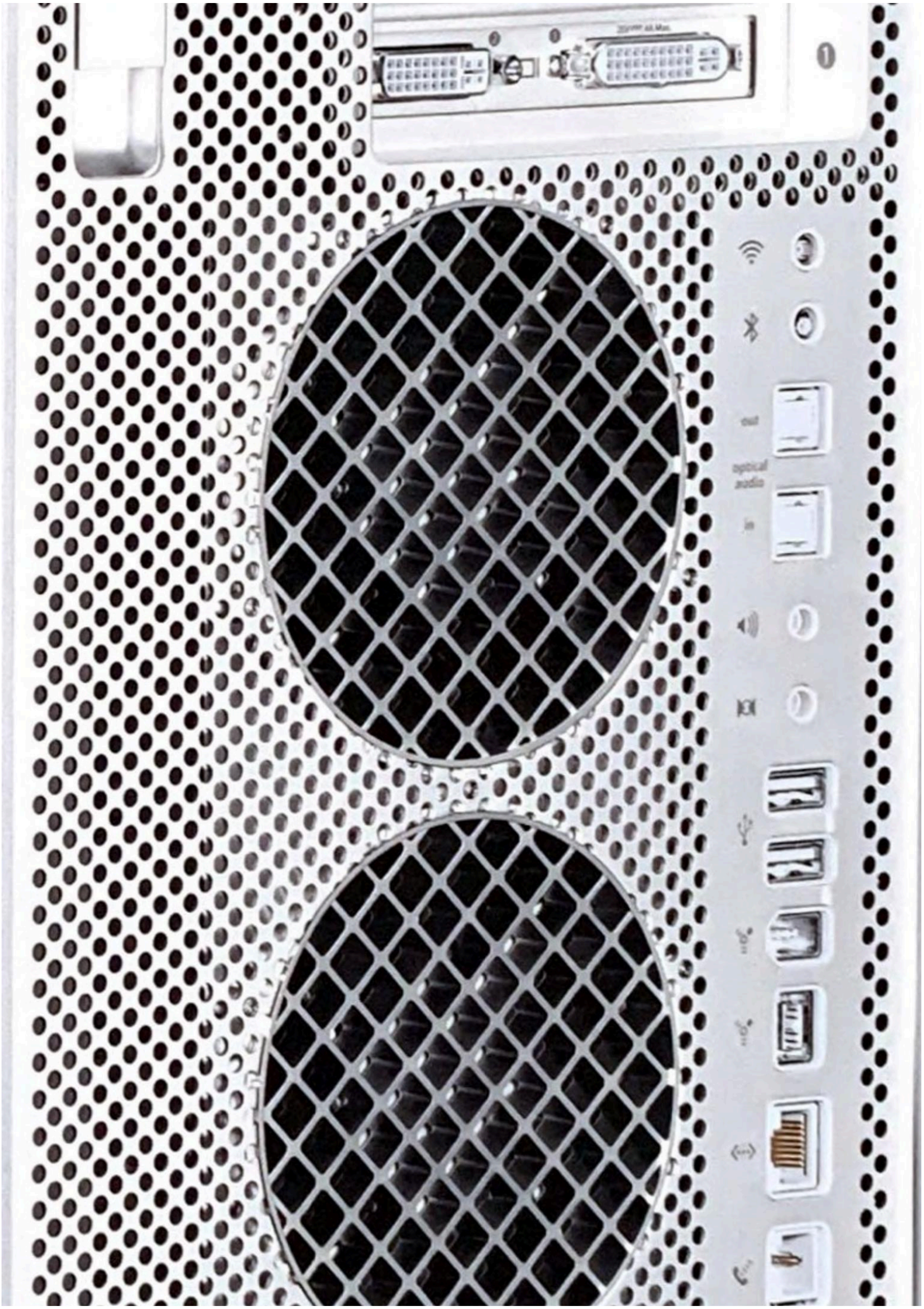
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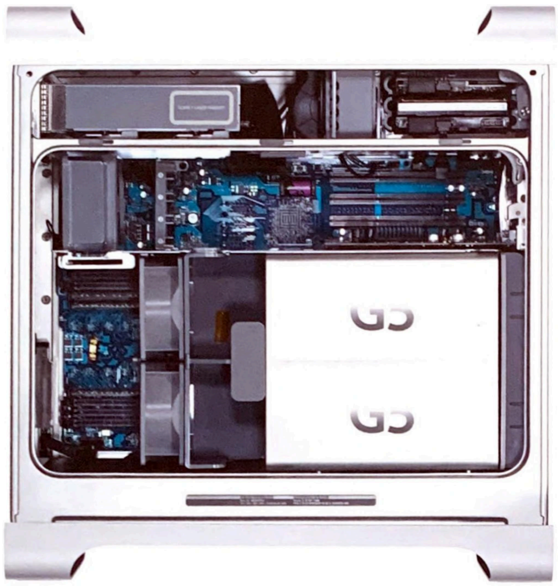
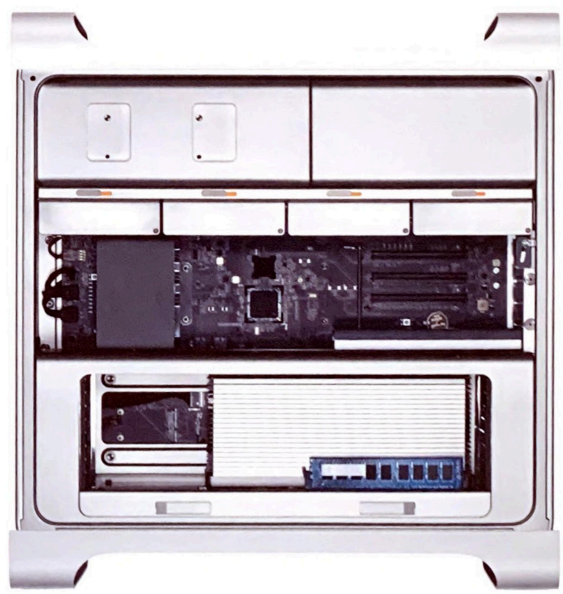
Power Mac G5. 2003-2006 ~76





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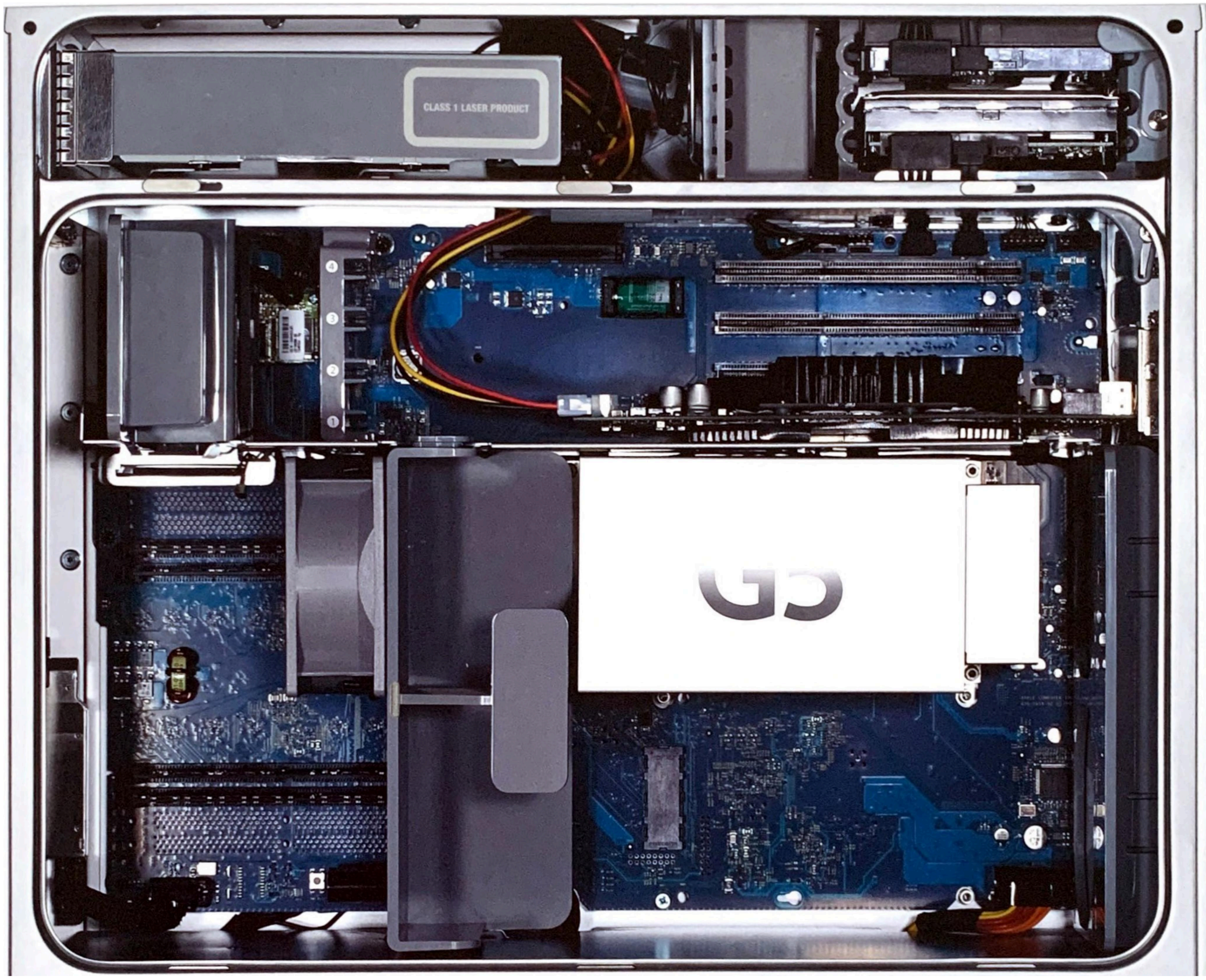

Apple Wireless Keyboard, 2003 78


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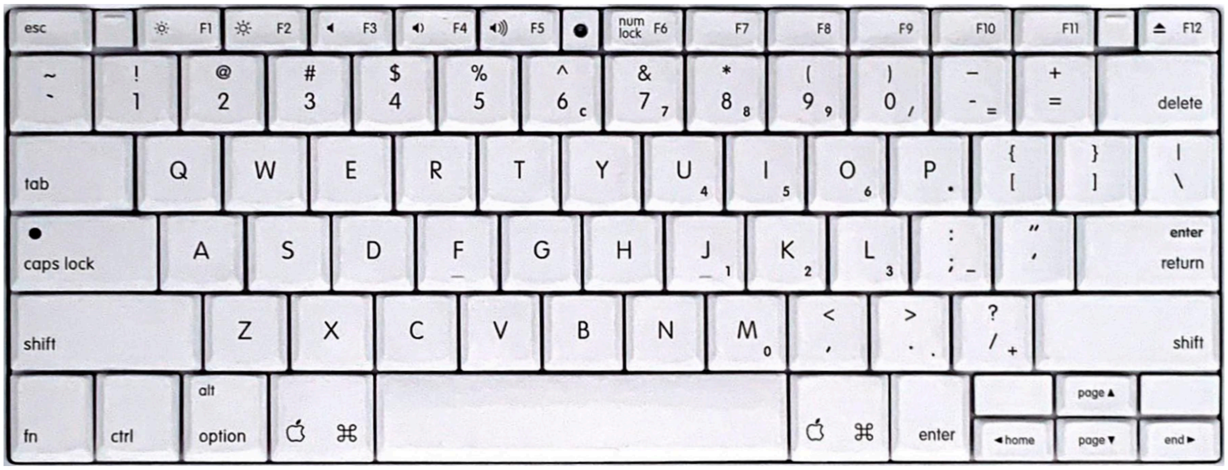
iBook G4, 2003 80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45W Power Adapter, 2003 82

i 83


Apple 45W Portable Power Adapter
Designed by Apple in California
Assembled in China Model No: A1036
45W
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iPod Serial No.: 5K642009QKI 0«»gned by Apple In Calitornia Assembled m China Model No: AK)S1 EMC No 1984 Rated S-30Vdc lOA Max TM and O 2004 Apple Computer. Inc All rtghis reserved pgCEBe

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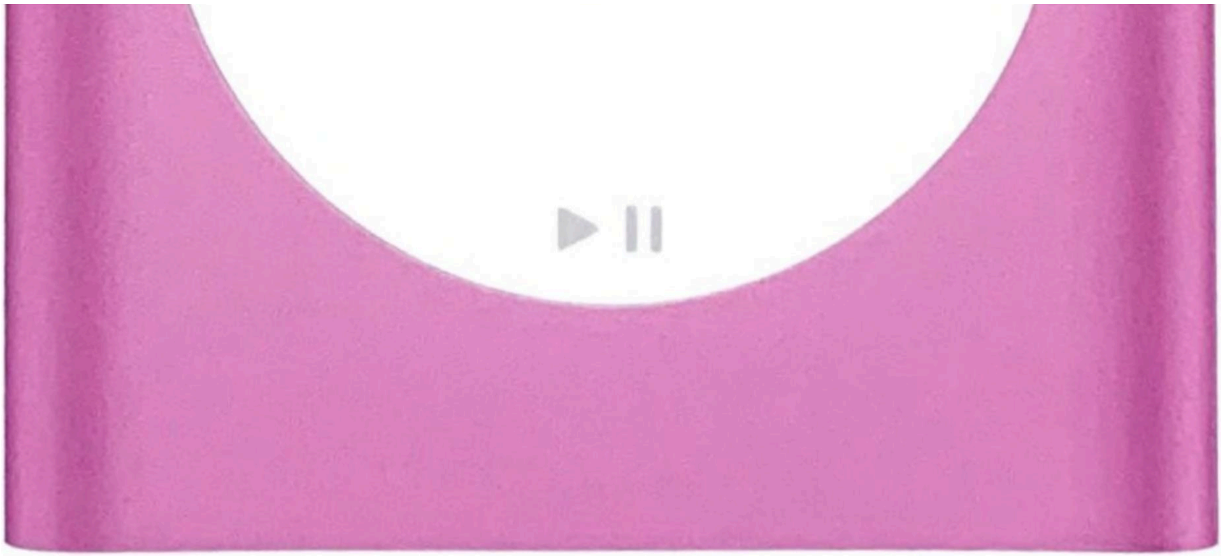
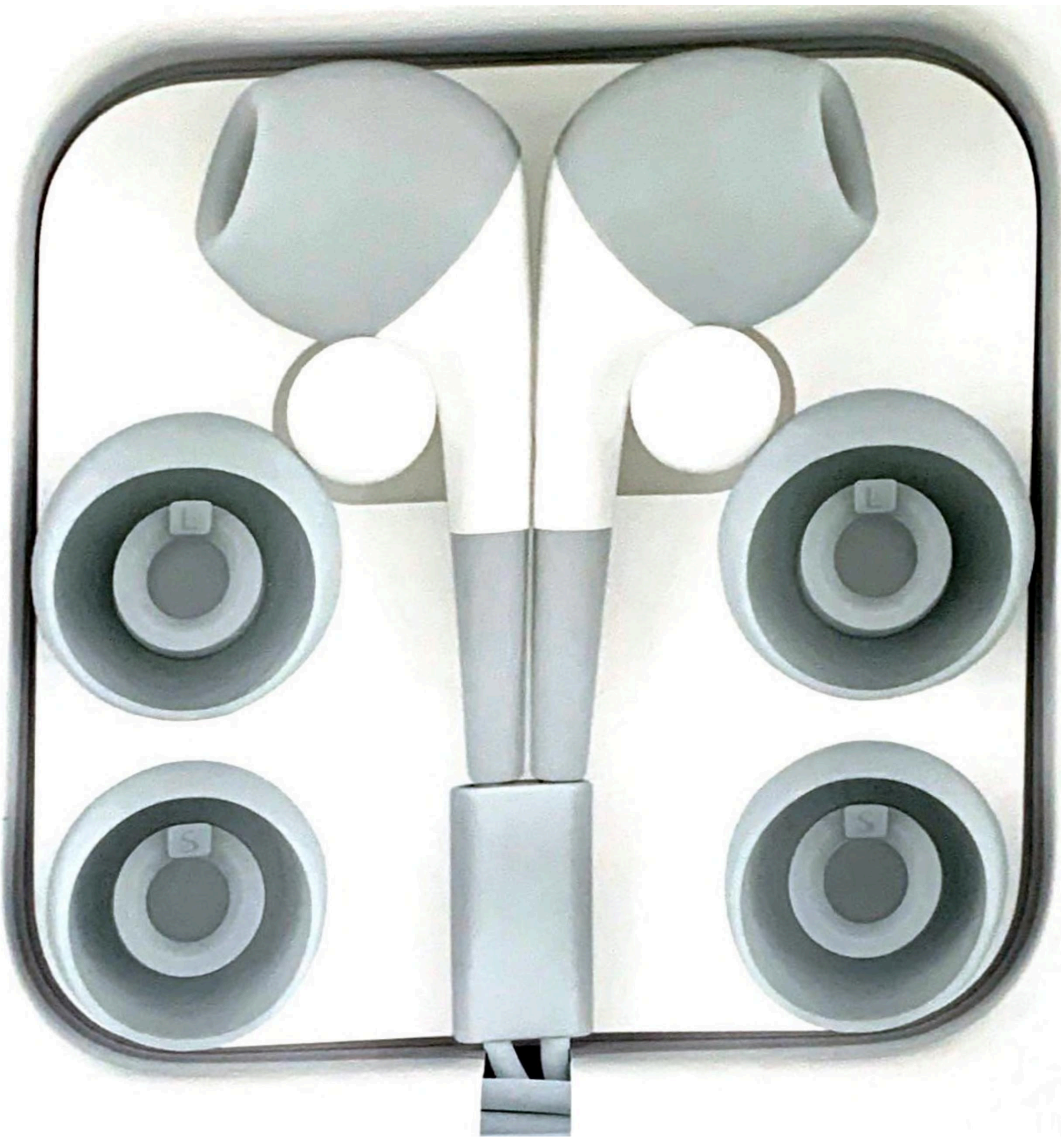


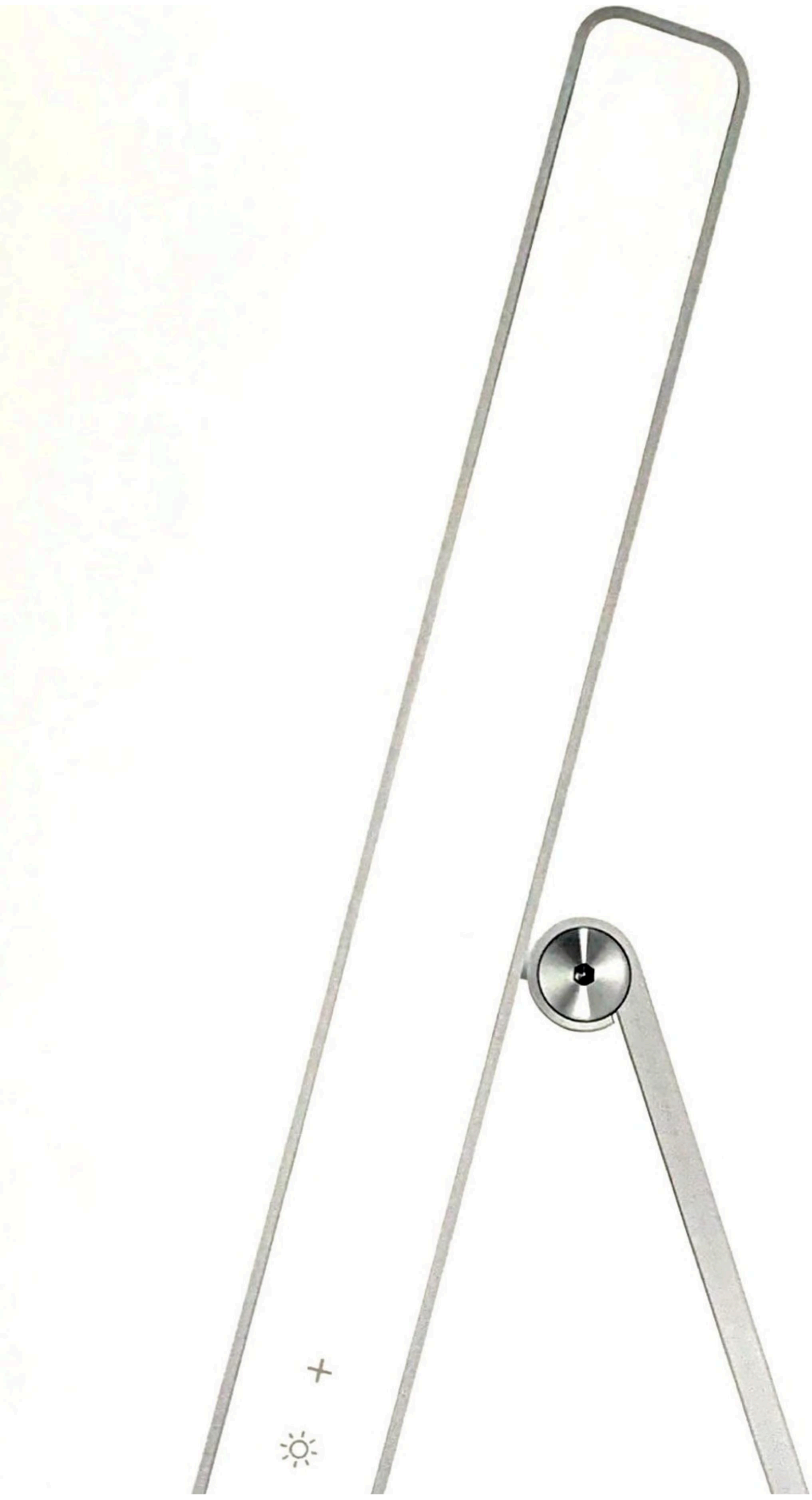
iPod mini Belt Clip 86


iPod mini Lanyard
iPod

iPod In-Ear Headphones, 2004 88



Cinema Display, 2004

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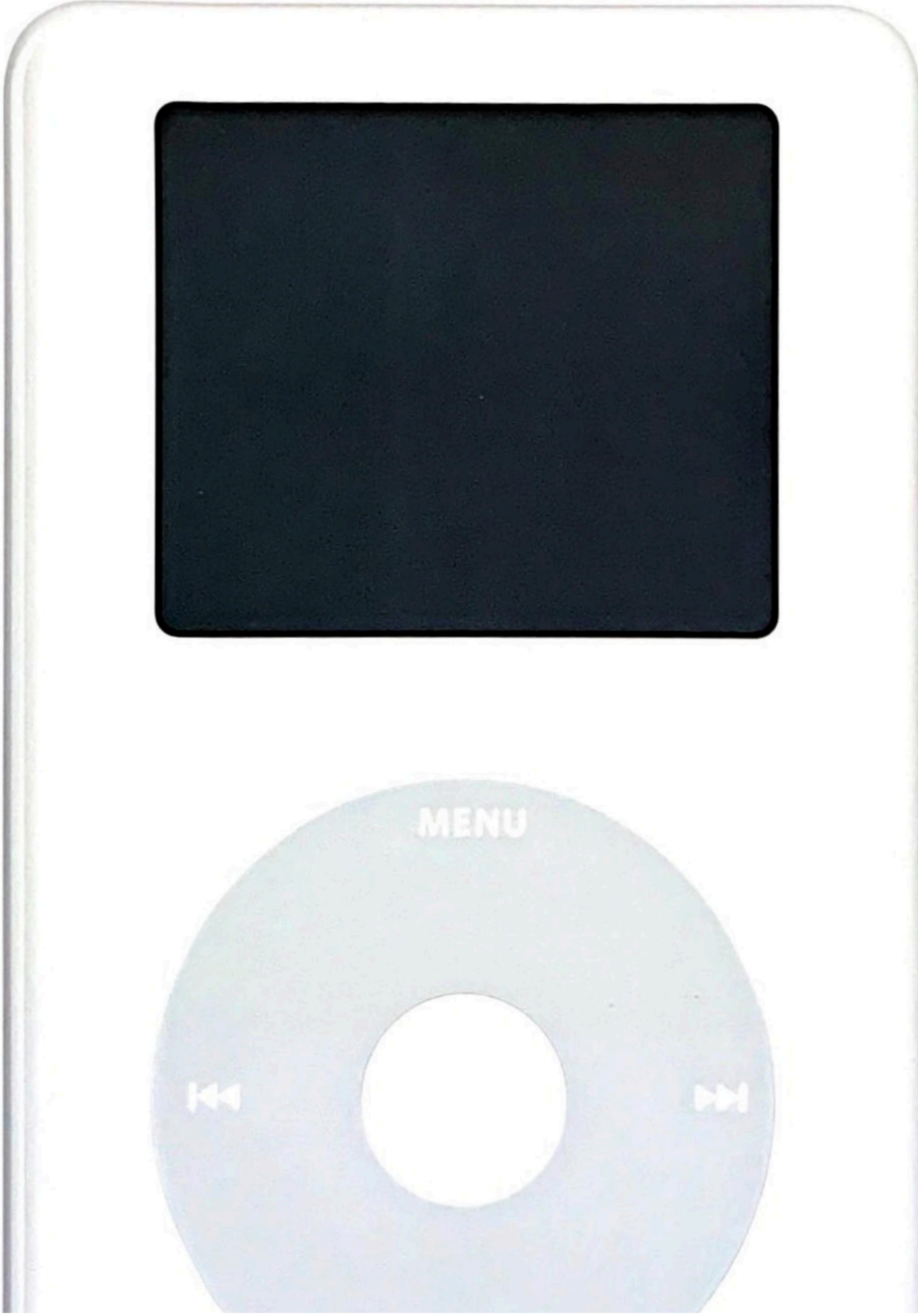
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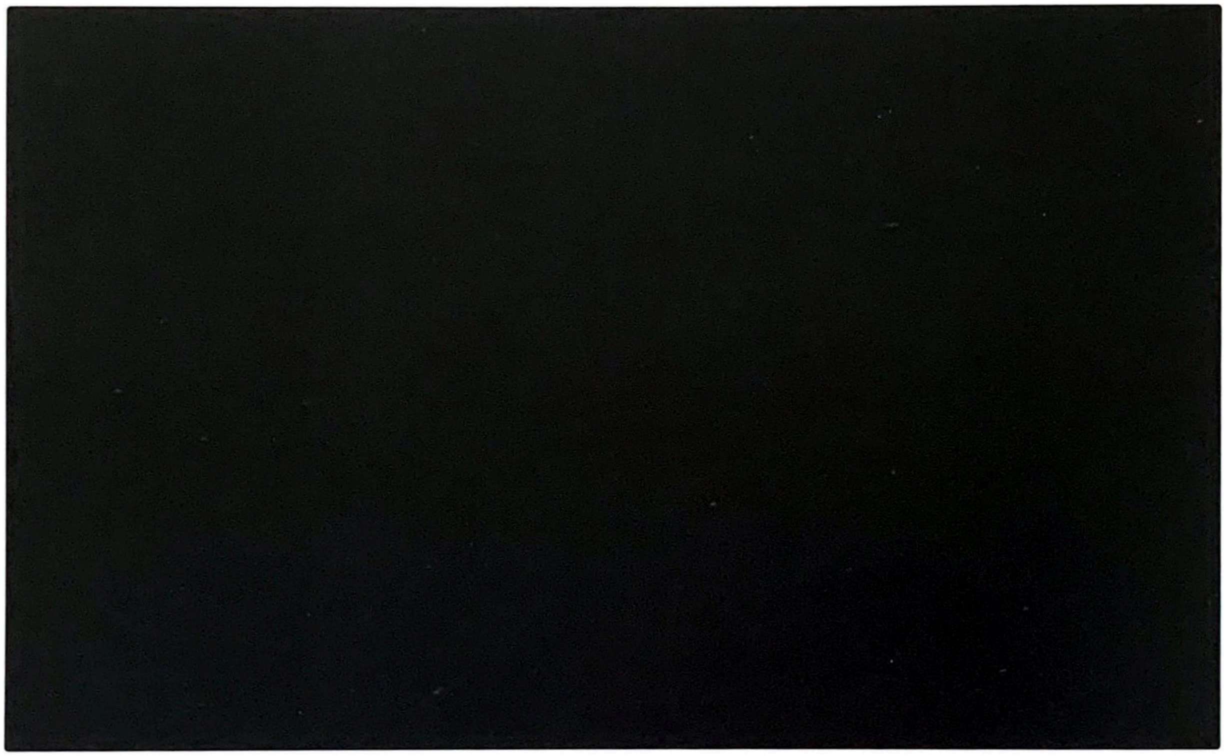

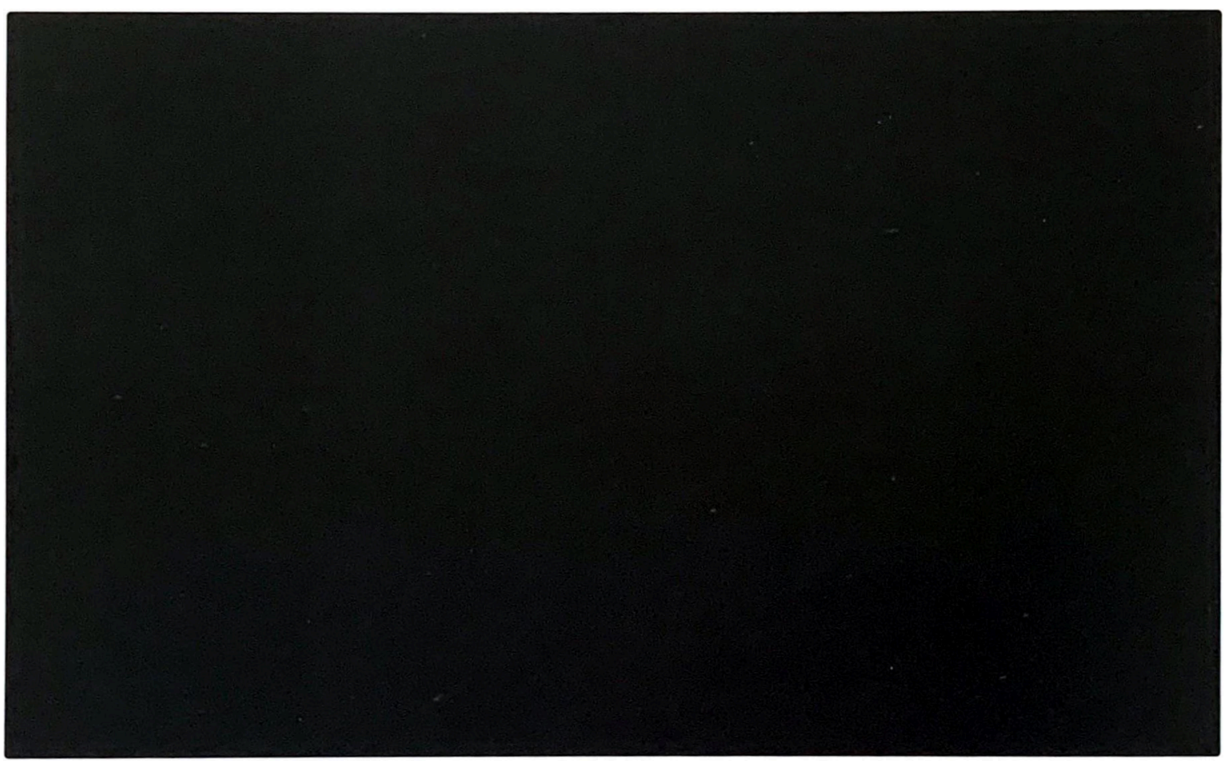

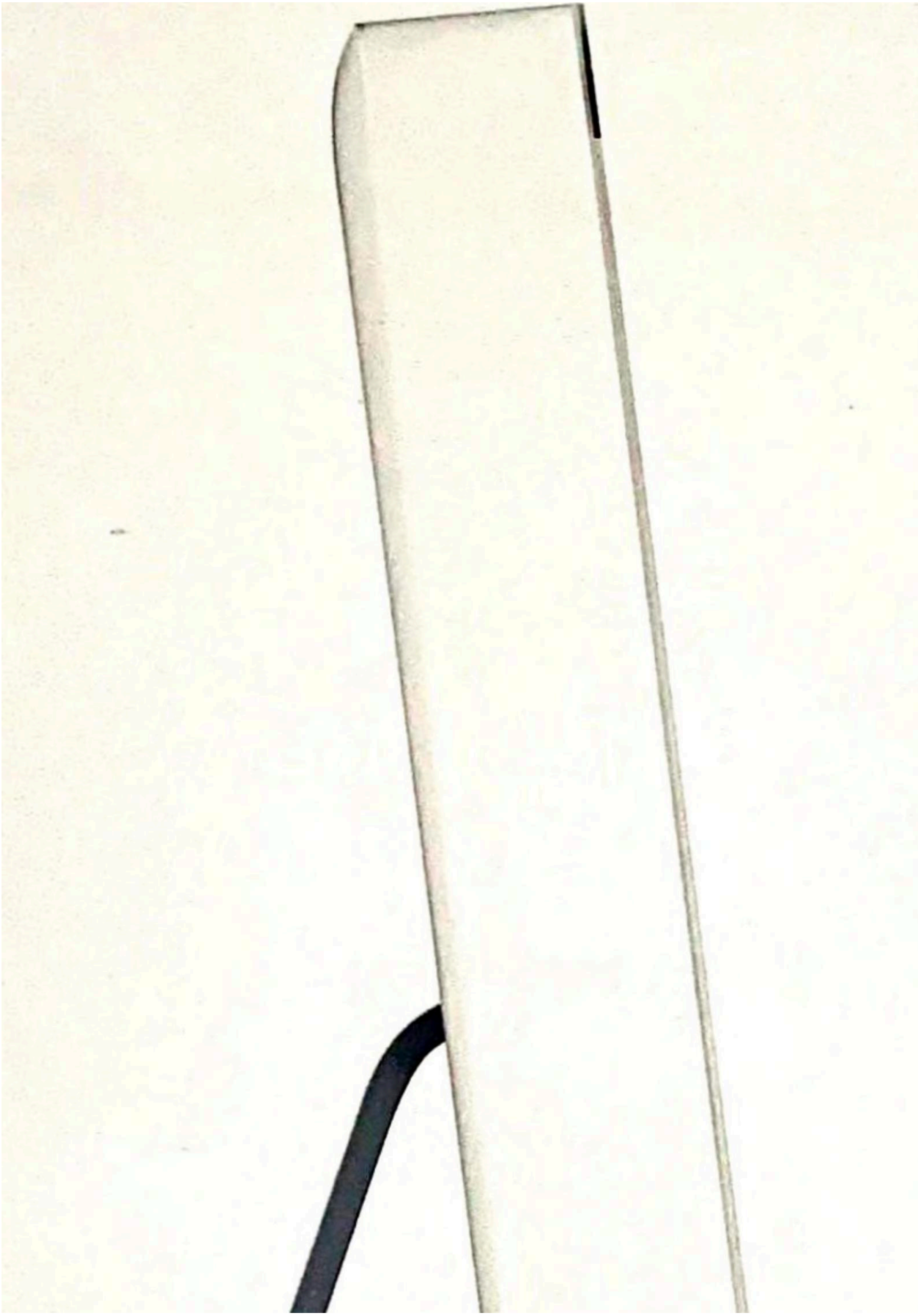

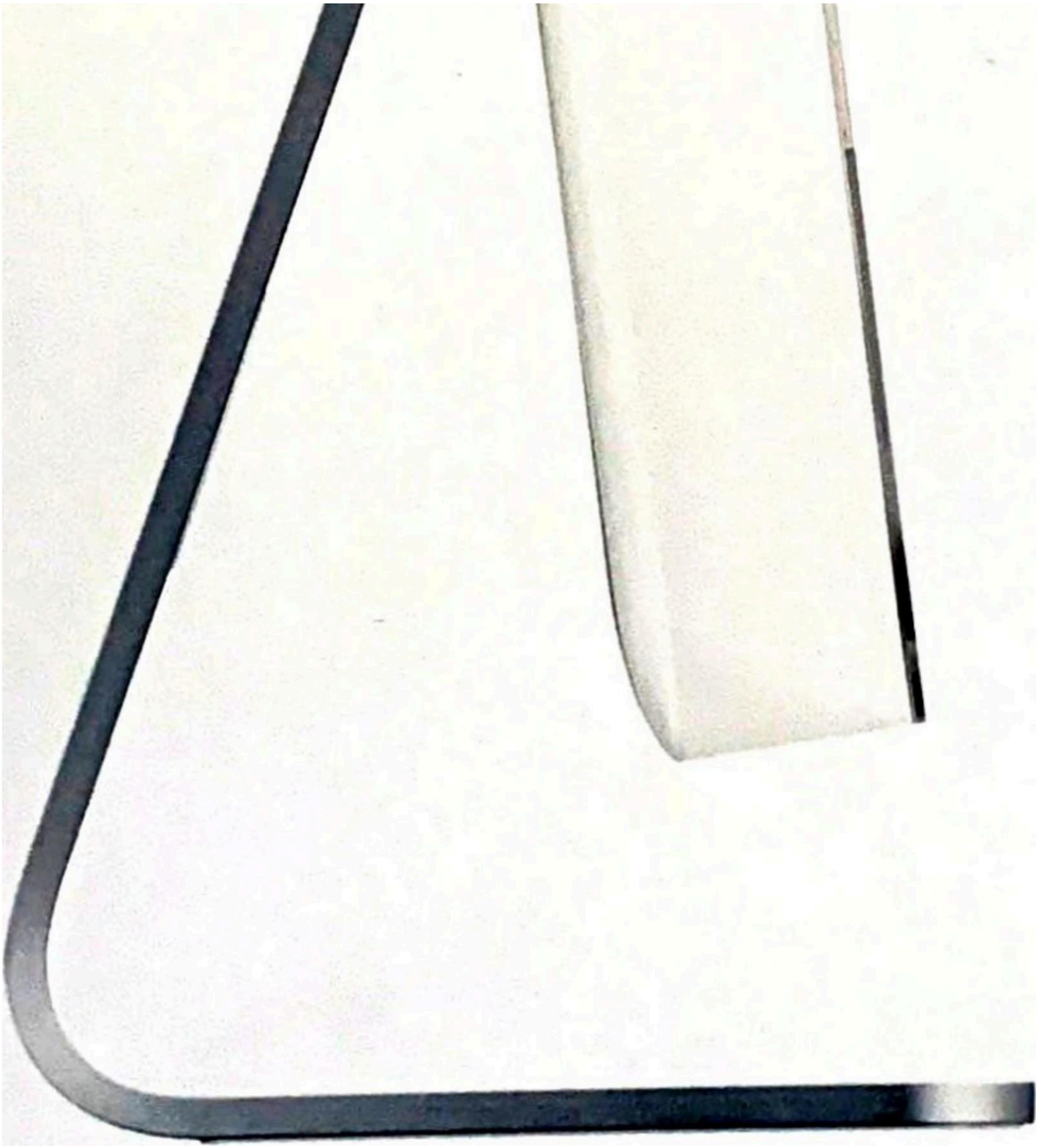

iMac G5 with iSight, 2004 / cz !) 1 o ®«aooiioiii

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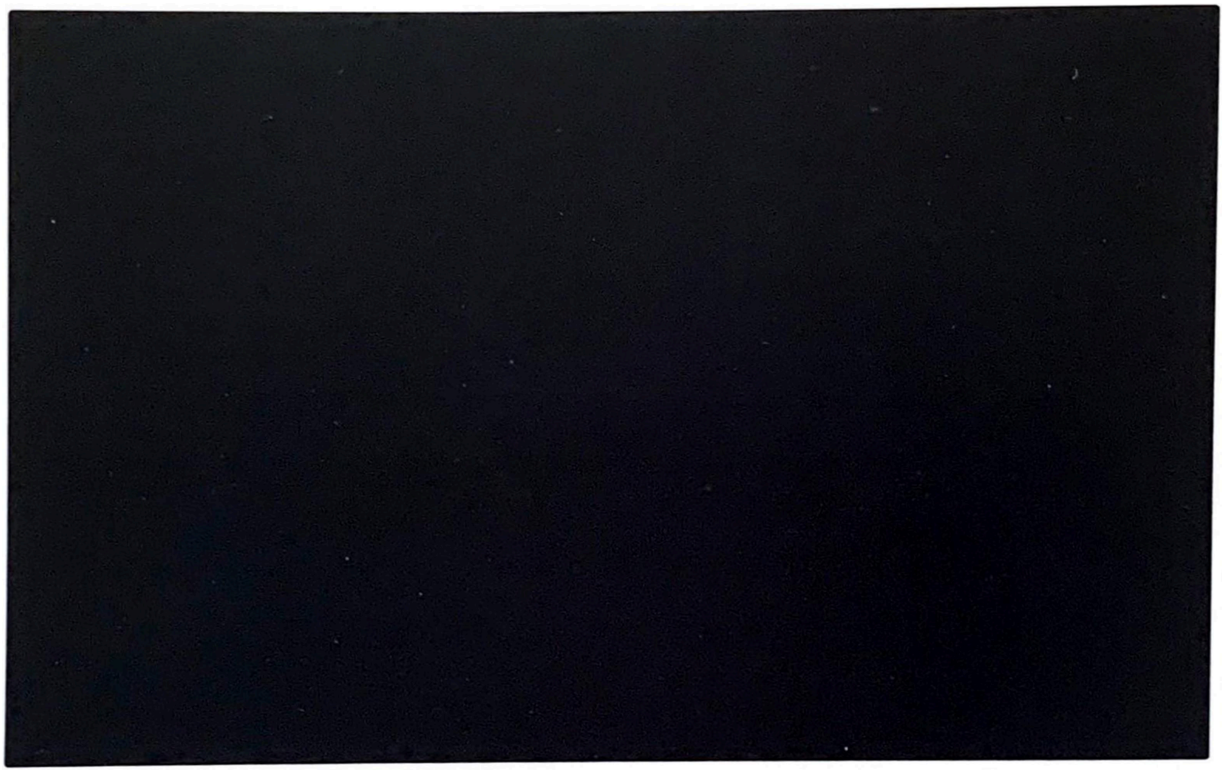

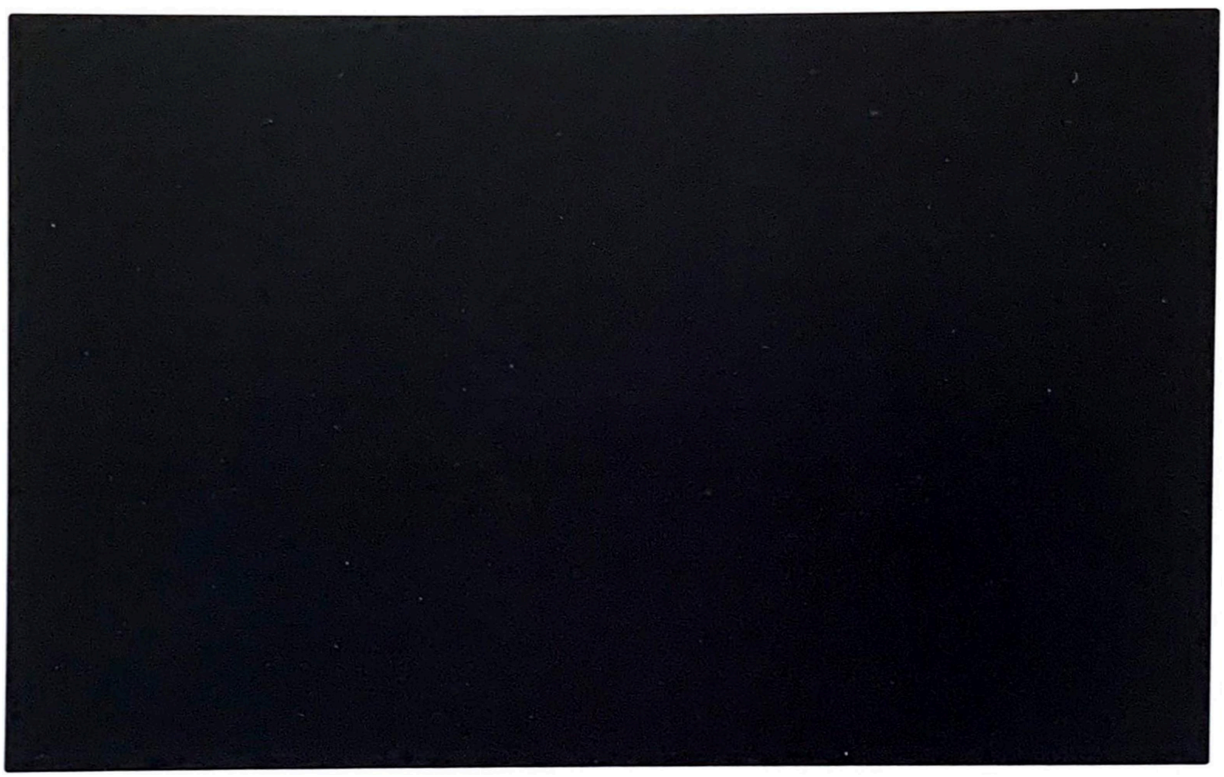

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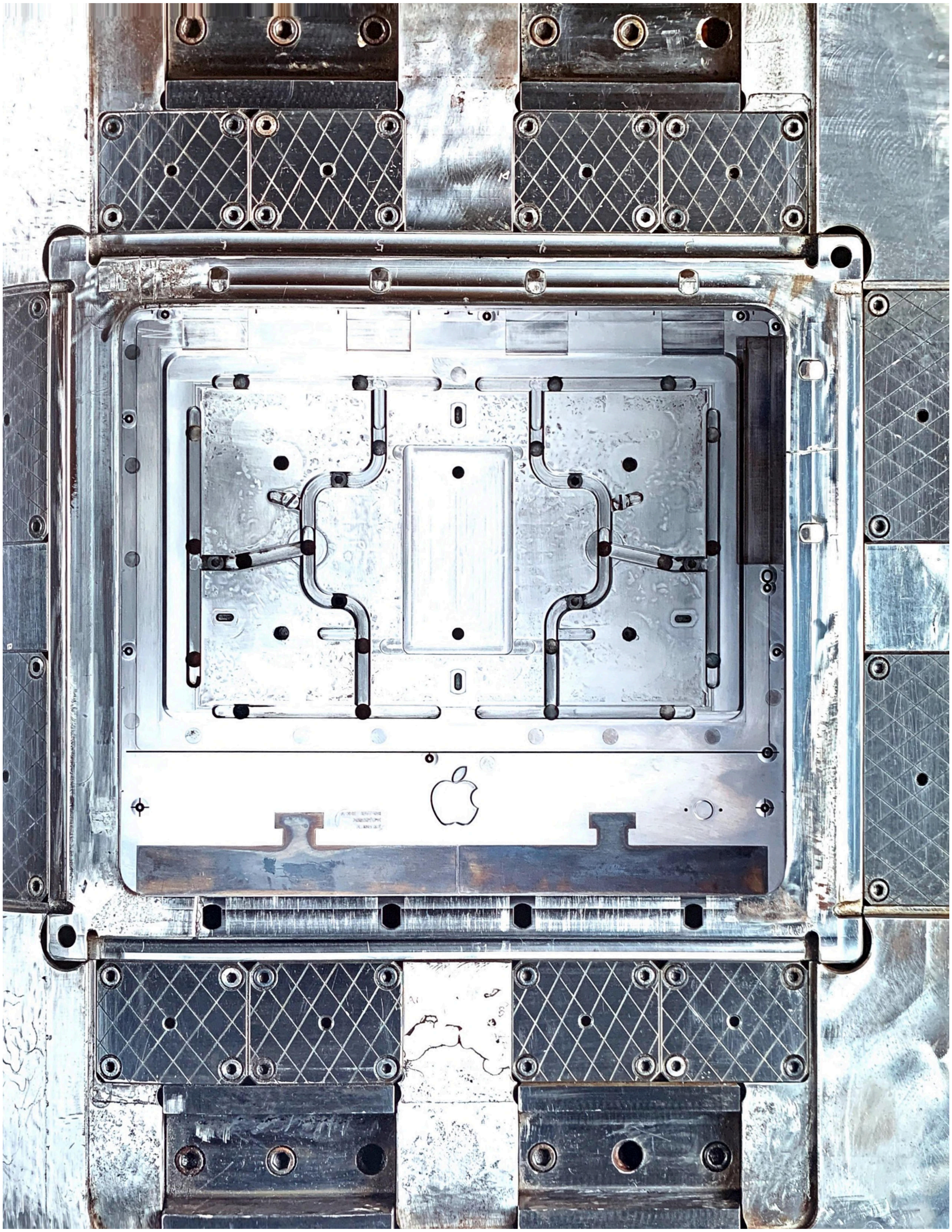
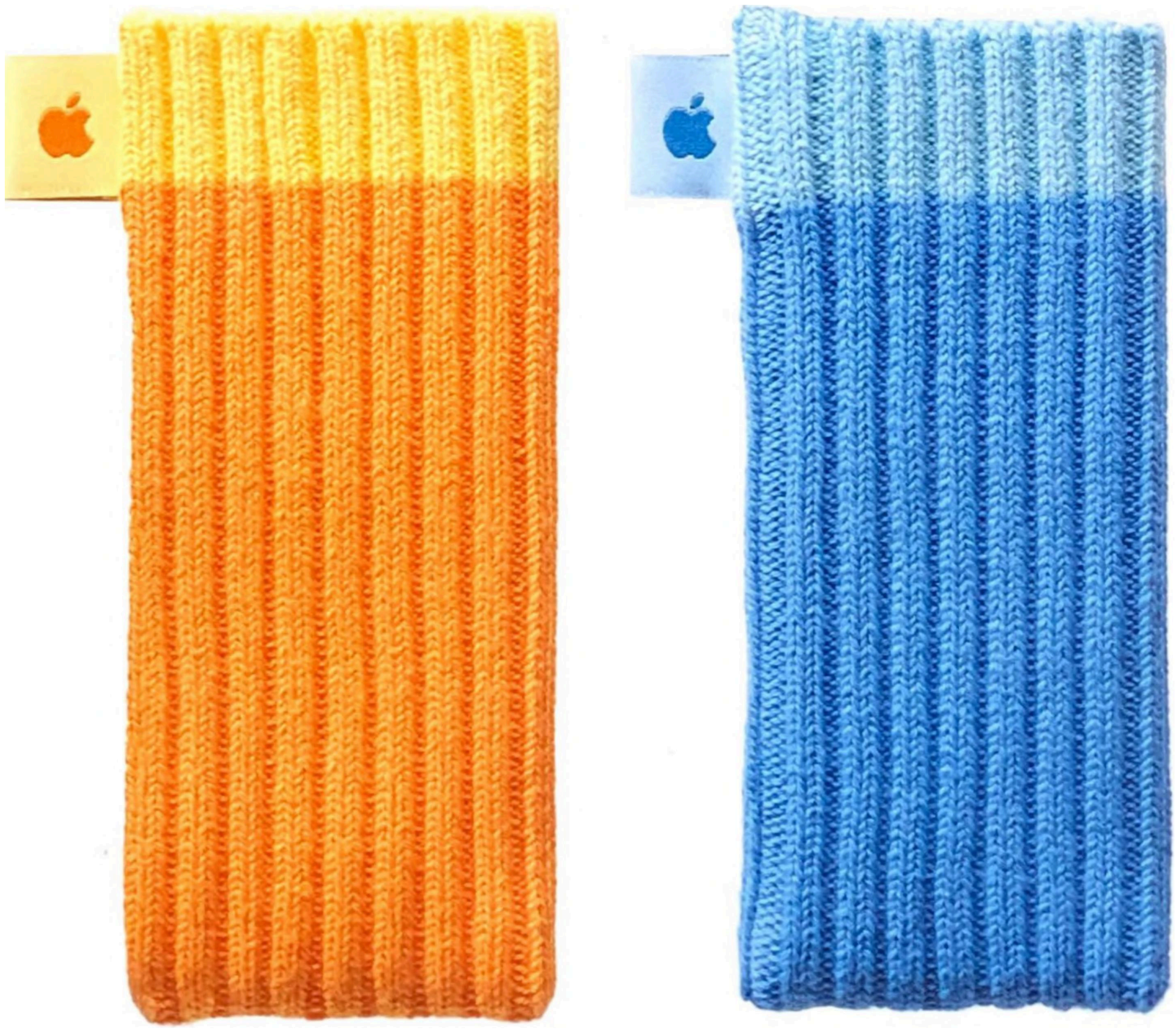
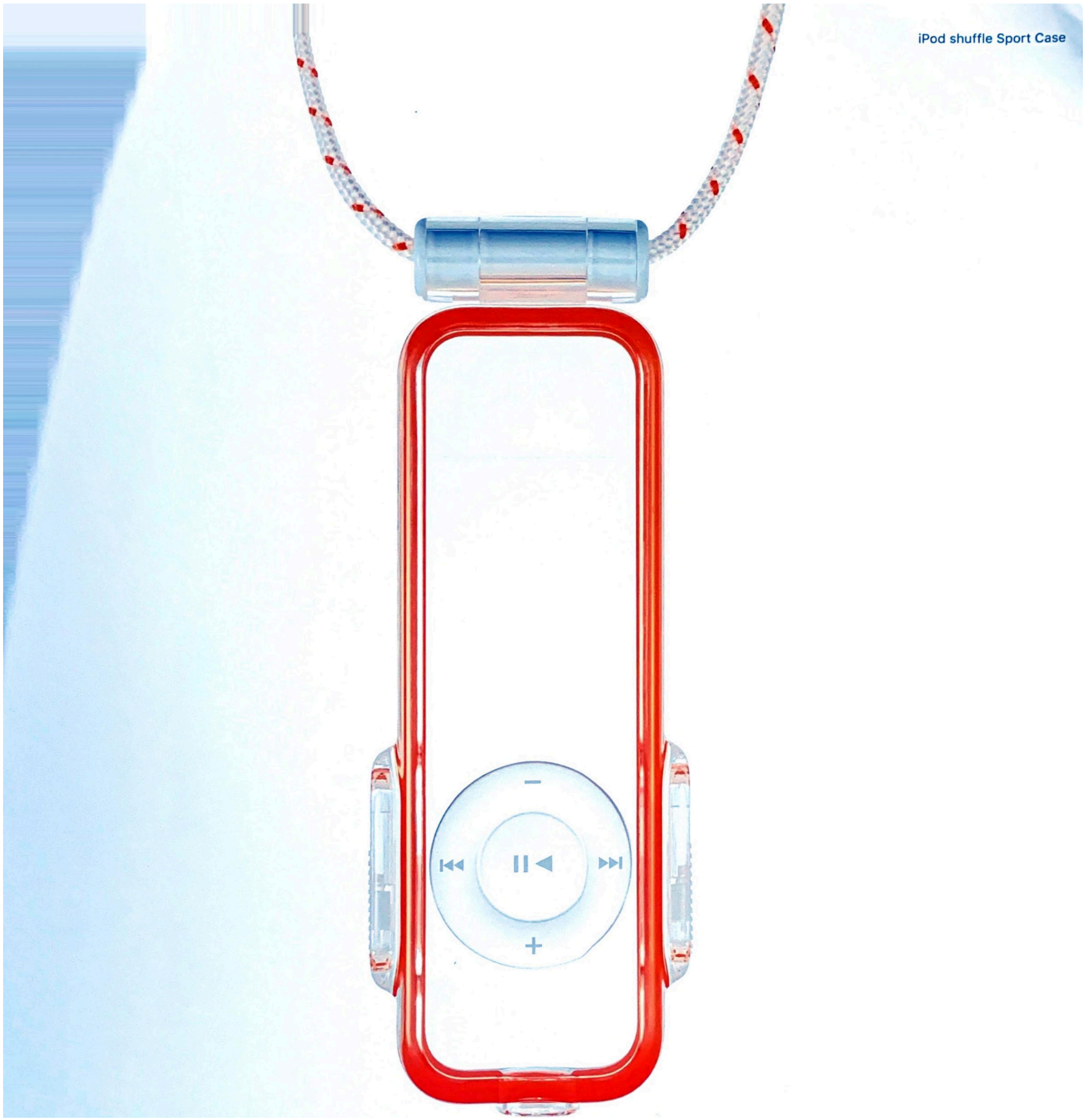


iPod Socks, 2004 104

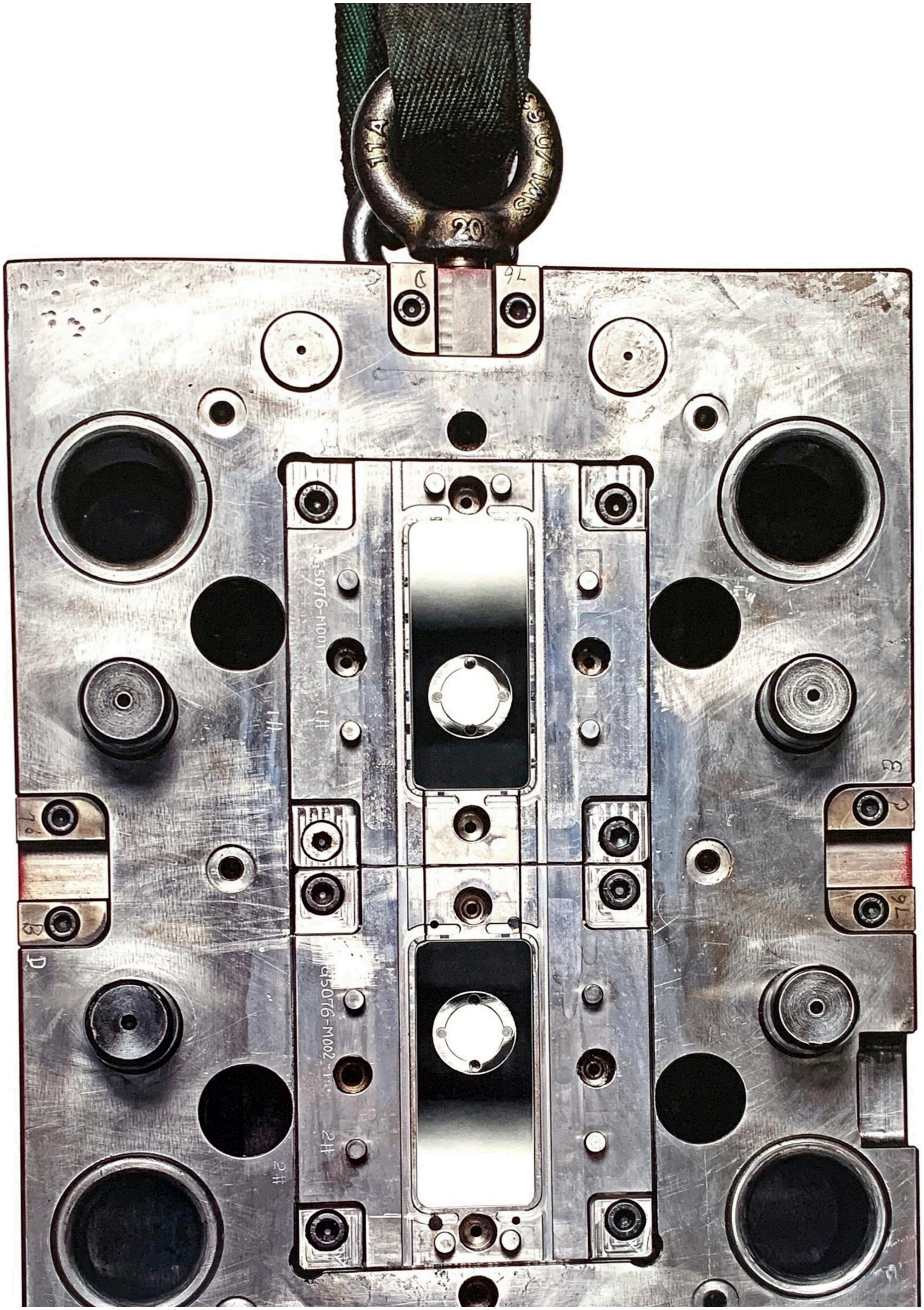


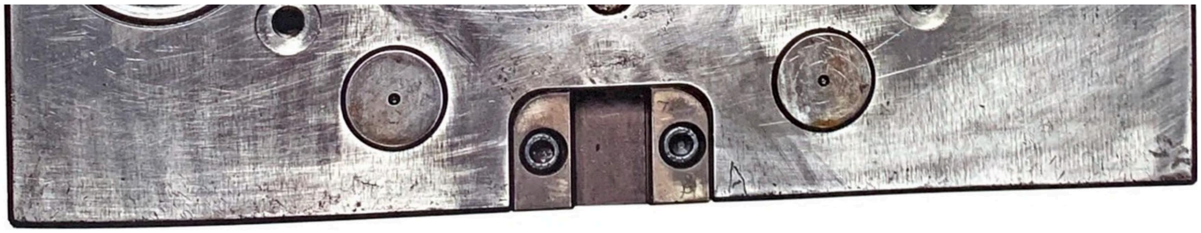

iPod

iPod shuffle Sport Case 107

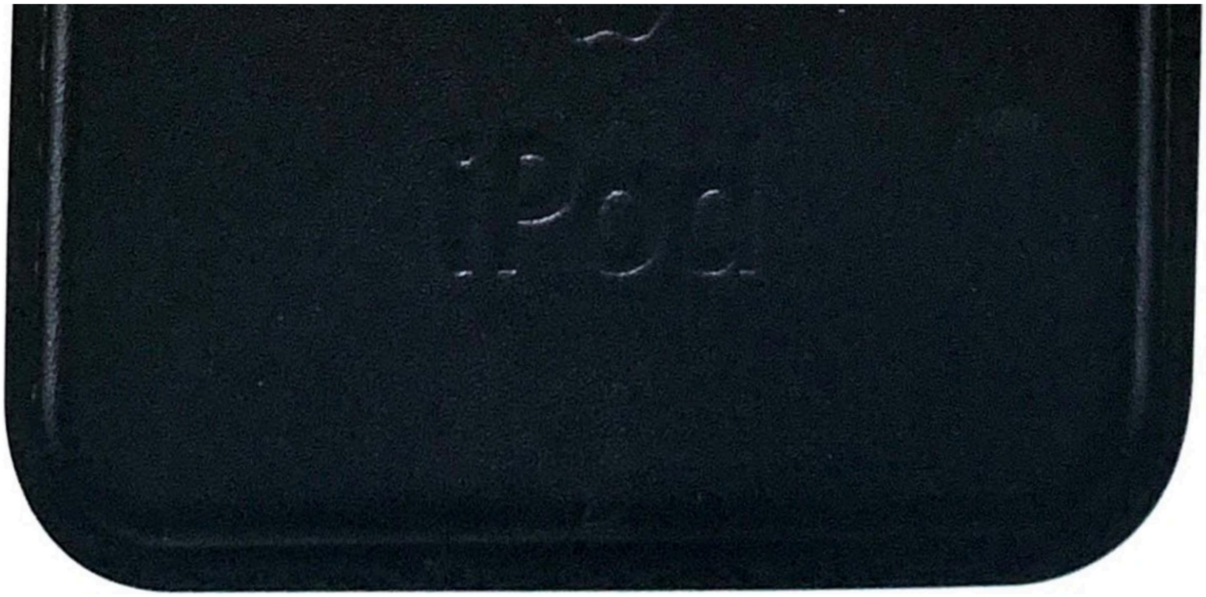


iPod nano, 2005 TOS



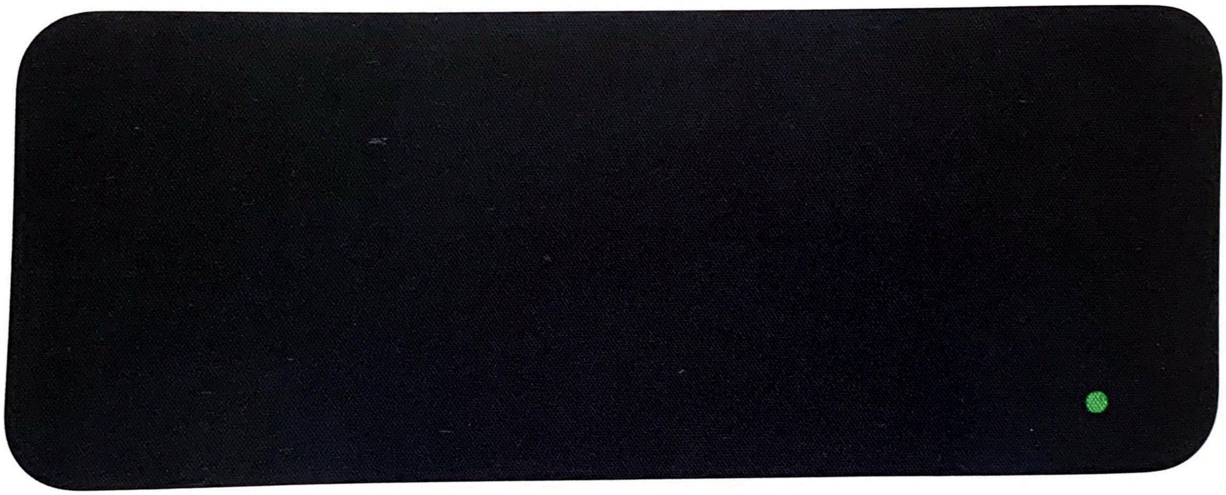


iPod Leather Case 110


iPod

iPod, 2005 111

iPod Hi-Fi, 2006 112



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MacBook, 2006

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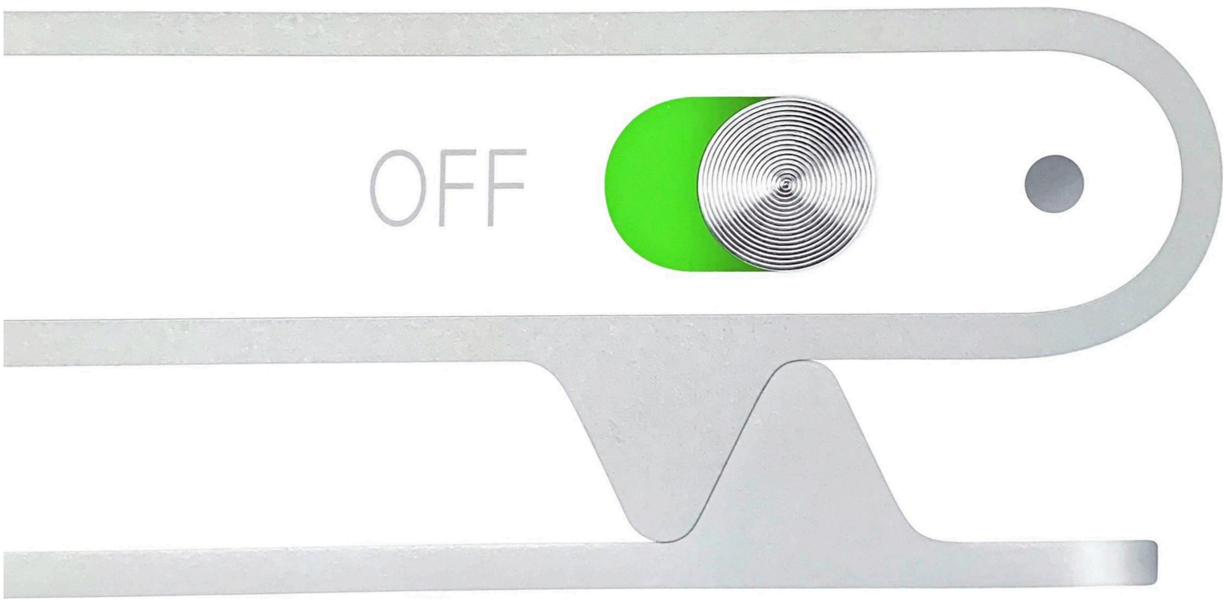
MENU

iPod shuffle. 2006 122



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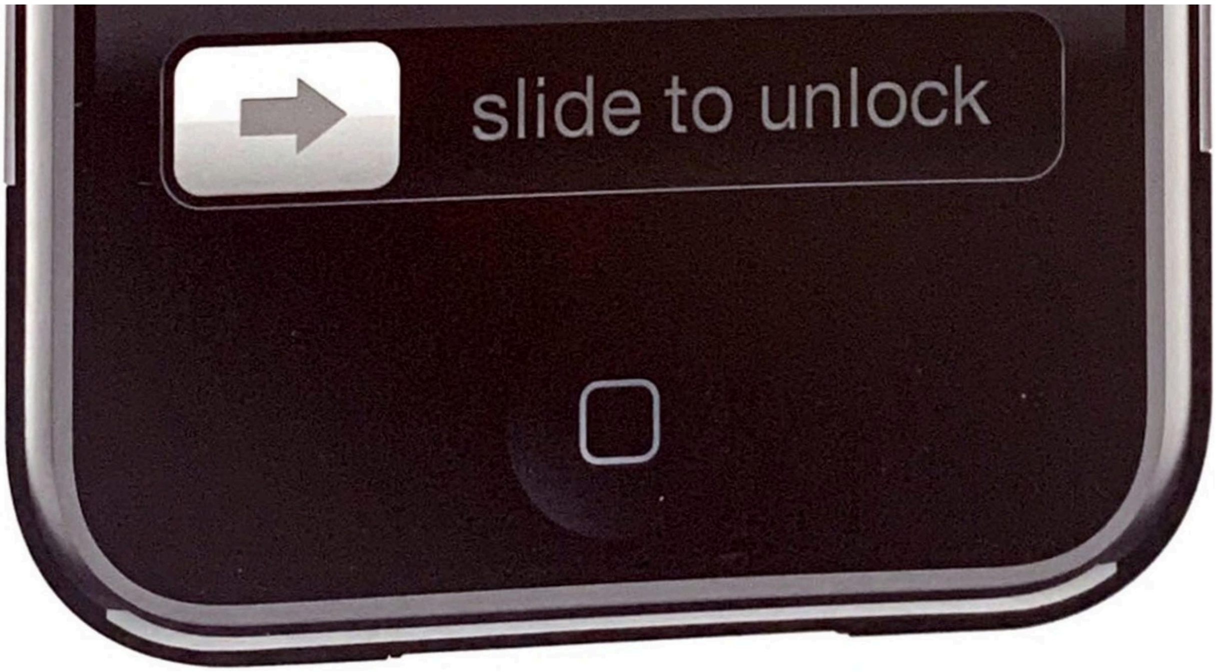
In-Ear Headphones, 2007 124

iPhone, 2007 iPhone Designed by Apple in California Assembled In China Model Noe A1203 FCC ID: BCGA1203 Serial Noe 7R725CXJLVRO IMEI Na;01 1245002370904 8GB


AT&T
09:42
Tuesday, January 9


slide to unlock

iPhone Designed by Apple in California Assembled In China Model No.: A1203 FCC ID: BCGA1203 Serial No.: 7R725DQLVRO IMEI No.:01 1245002370904 8GB


J6
APPLE
821-0449-09
© 2007

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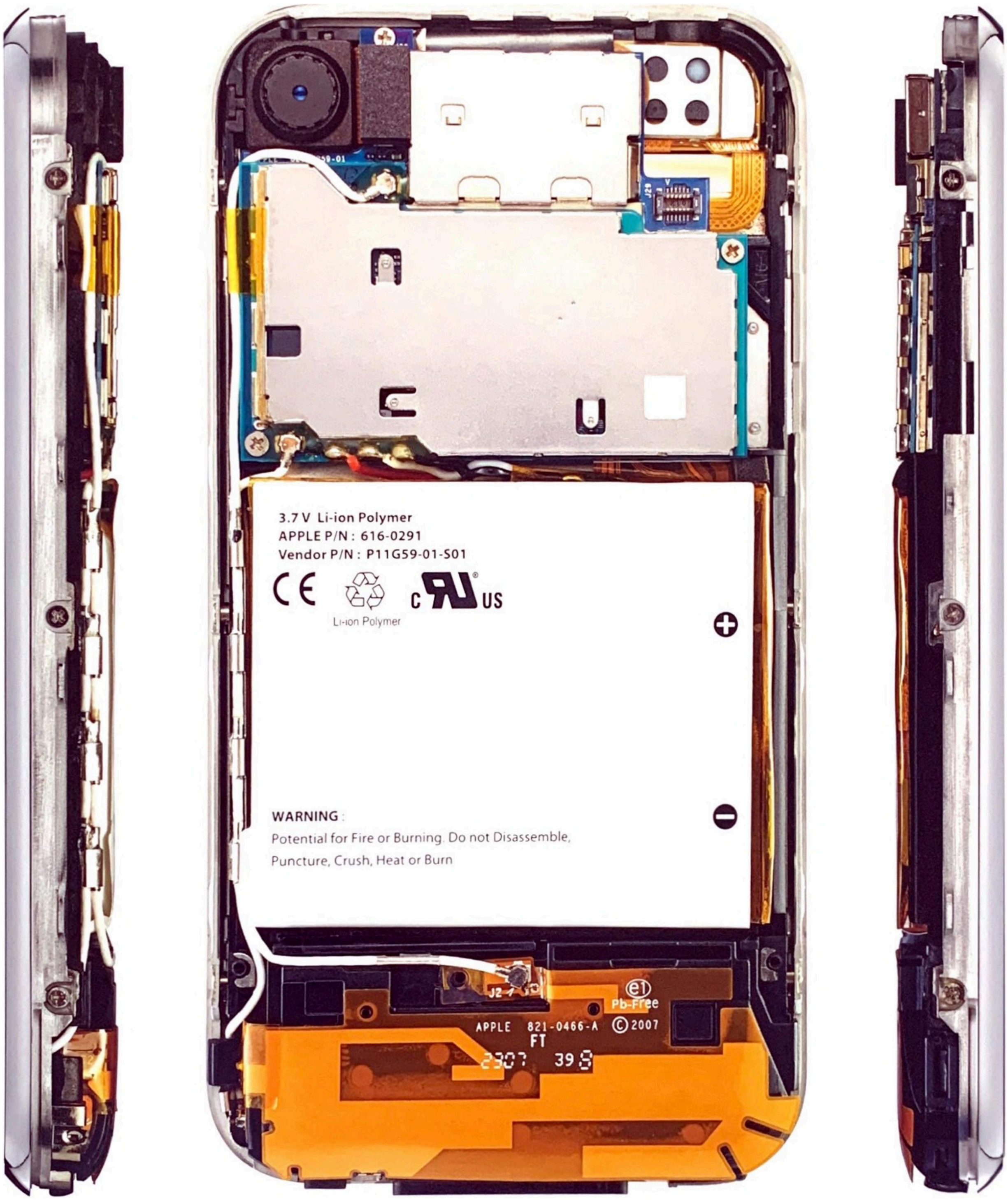
131



132

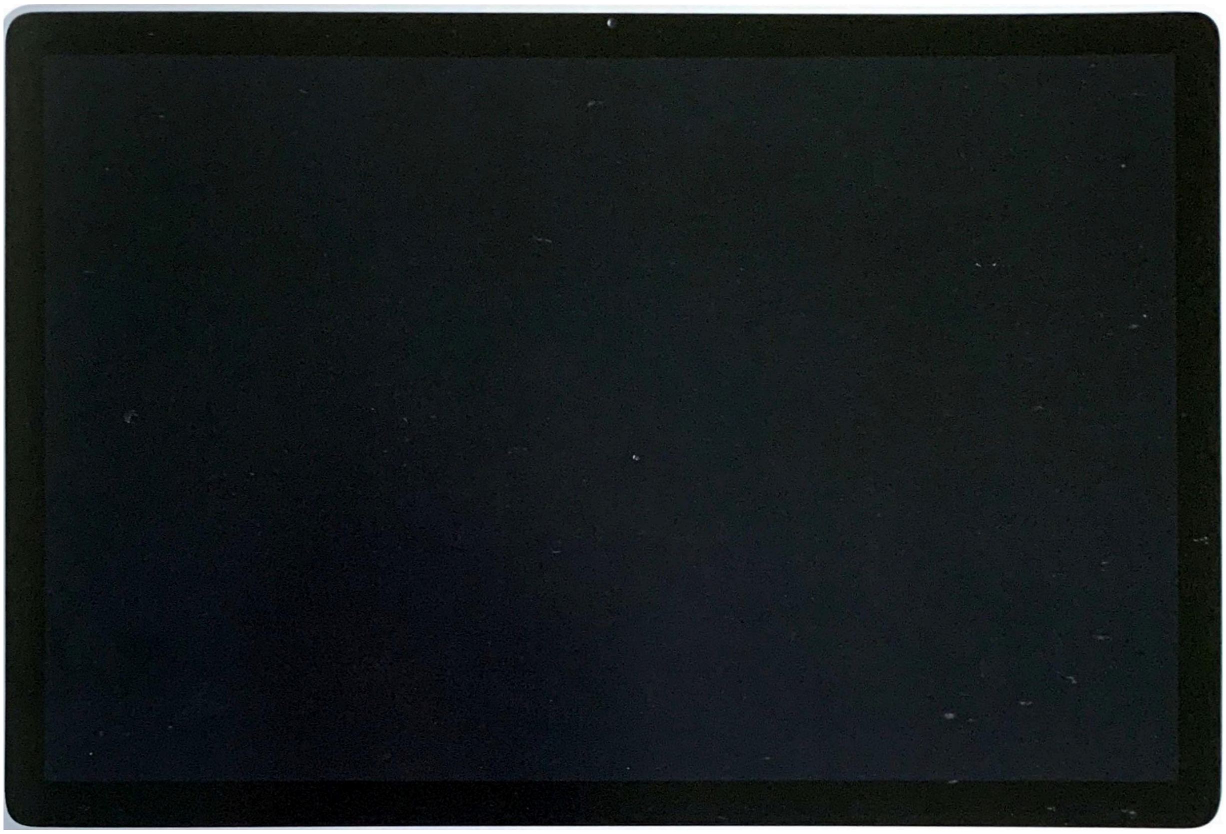
133


iPhone
16GB

iPhone Headphones, 2007

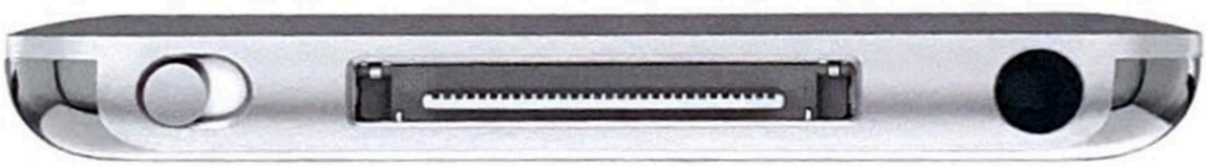

iMac, 2007 138

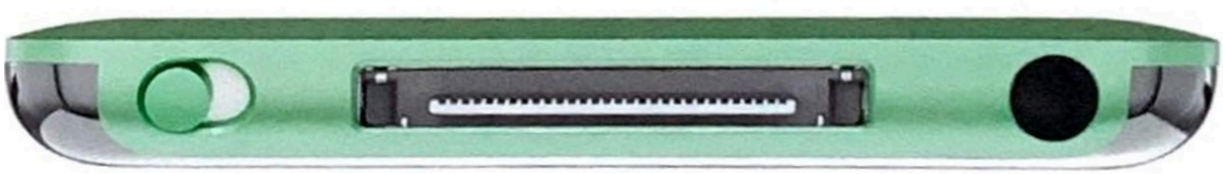
139



pple Keyboatcl, 2007 F15 page up page down r - FI6 fl7 F18 L _ J F19 ^ - N f > clear = / * r X 7 00 9 — L _ A 4 5 6 + r - N 1 CM CO _ 4 f . f - ^ 0 • enter 143

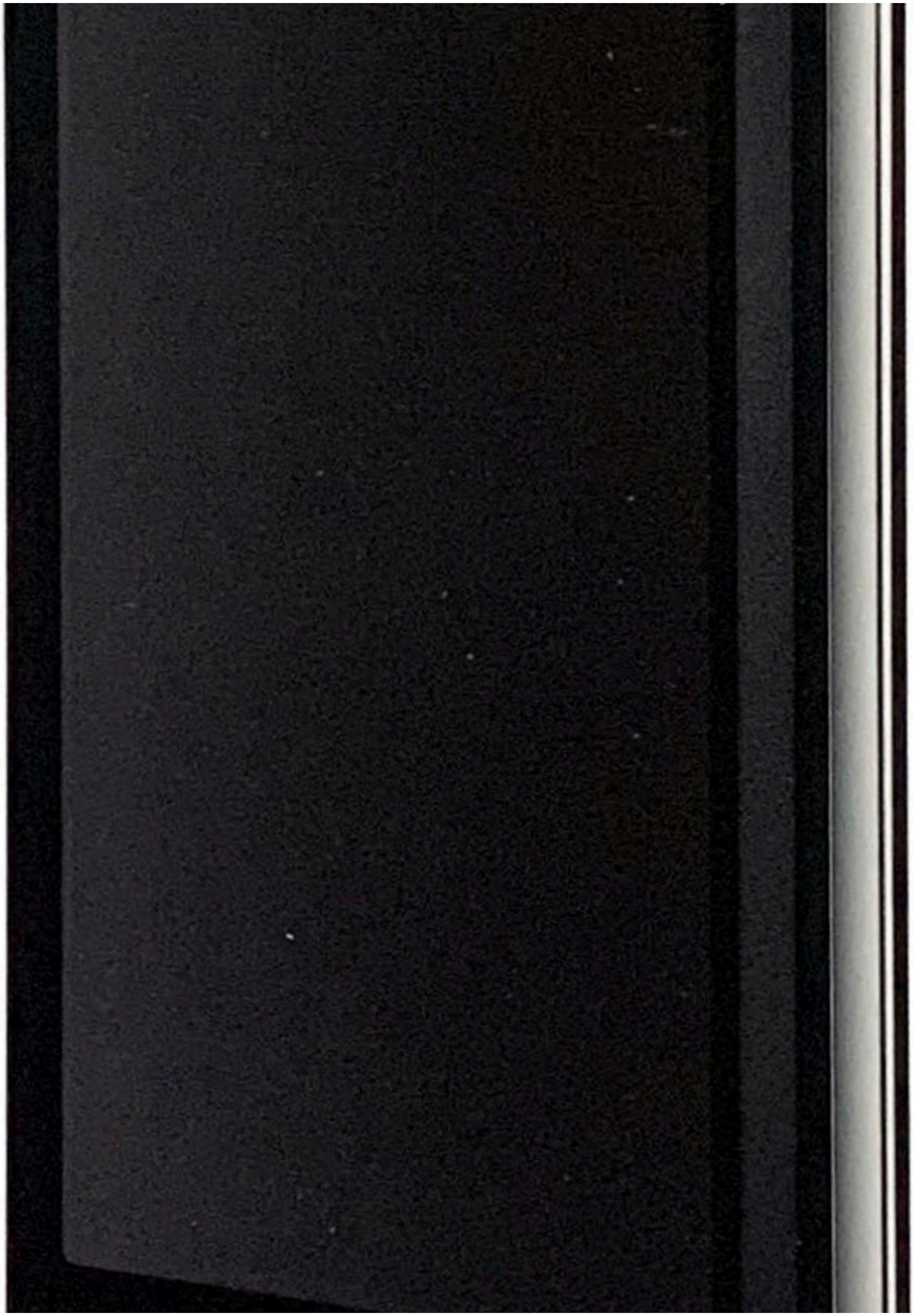
iPod nano, 2007 144






MENU


iPod
16GB
Serial No.:1A7436UW4N
Designed by Apple in California. Assembled in China. Model No.: A1213
Rated 5-30V 1A Max. Contains FCC ID: BCGA1213 and IC ID: 579C-A121
TM and © 2007 Apple Inc. All rights reserved.
N122
Z644



lassie, 2007


iPod
160GB
Serial No. 8K742L64YSN


Designed by Apple in California Assembled in China Model No.
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149


MENU

MacBook Air, 2008 150

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151

iPhone 3G, 2008 152

iPhone I 32GB I Designed by Apple in California Assembled in China Model No.:A1303 FCC ID;BCGA1303A 1C ID: 579C-A1303A

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154


6
7

5
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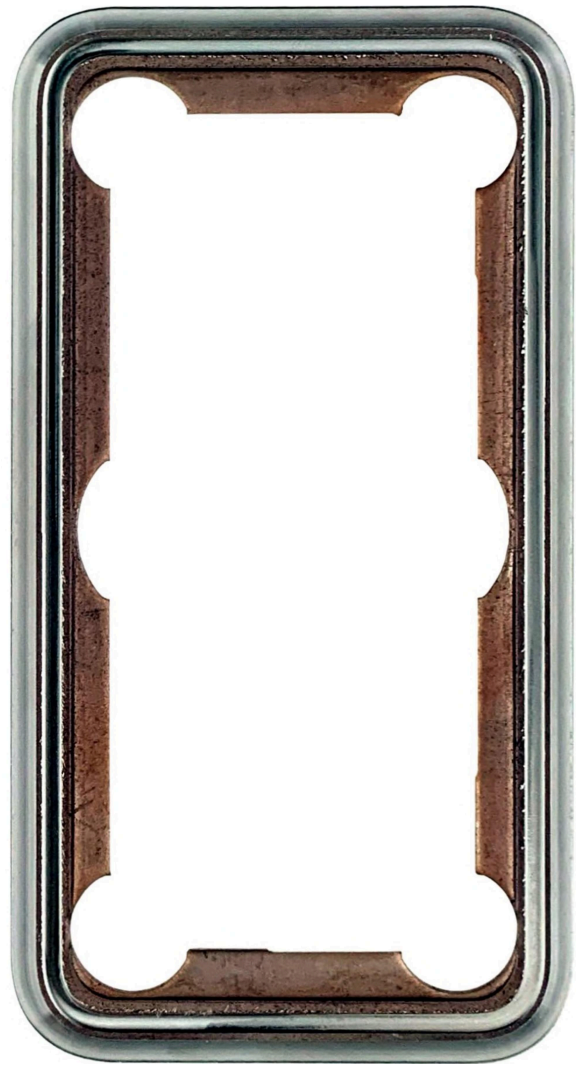
Do not remove
APPLE
©2008
HF/e1
821-0551-08


iPhone
16GB
Designed by Apple in California Assembled in China
Model No.: A1241 FCC ID: BCGA1241 IC ID: 579C-A1241
0682

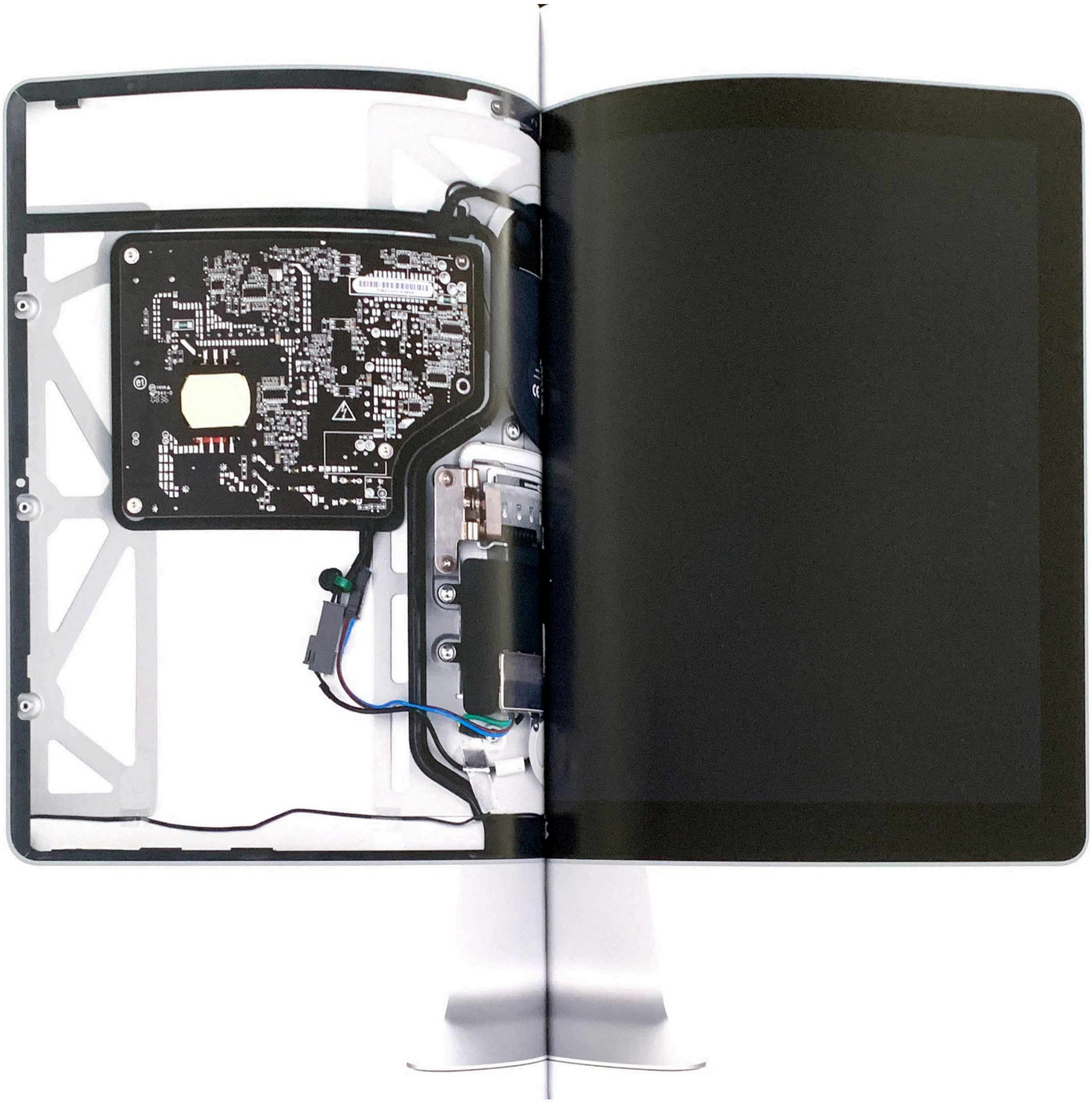
158



iPod touch, 2008 160

Serial No:! A8407T2201 nned bv Aople in California Assembled in China Model No . A 1288 7M«.ConU,i«FCCB.6CGA128i.«

I to Cinema Displav. 2008 162 16'^



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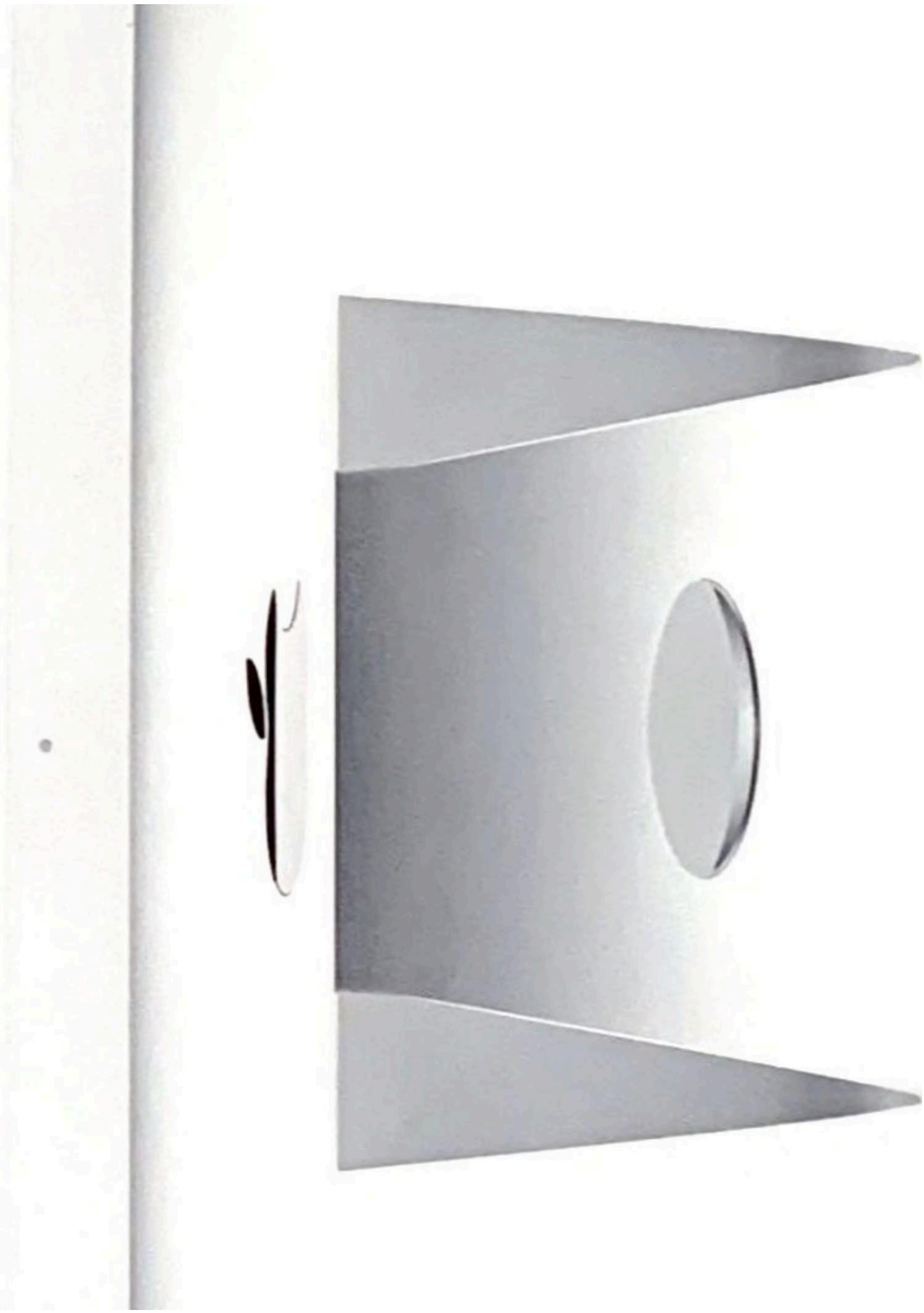
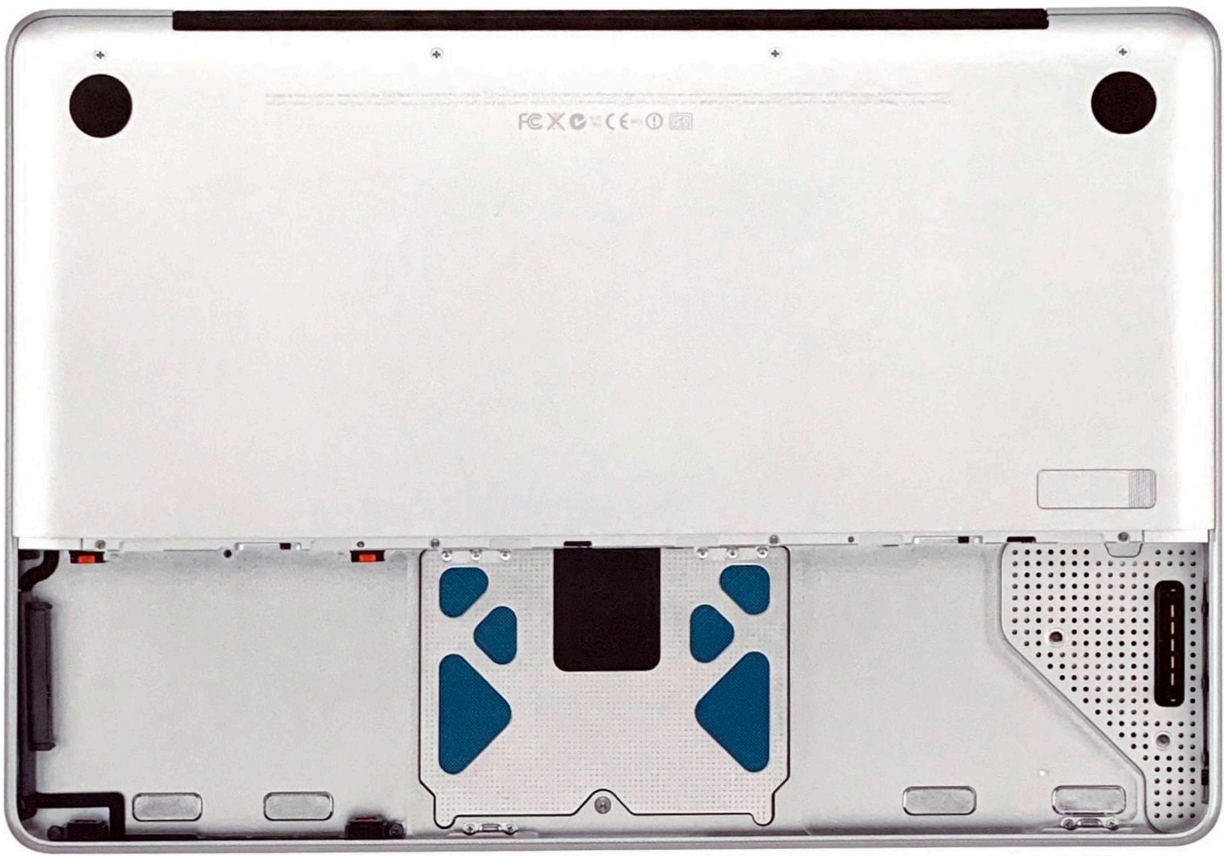
I I I a • • • HP*** • •••• IP**** PiT* • • _•••• _%*•*•*• • ••• • • • • • • ••• • •••• • ••• • •••• • ••• K *•••*• • •••• • ••• • •••• • ••• • •••• • ••• • •••• . •••• Iv.w • •••• iw.v • •••• • ••• • •••• • ••• - • • • • ■••••• B •••• • •••• • ••• • •••• • ••• • •••• • ••• • • ••• • ••• • •••• • ••• • • • • • •••• • ••• • • •• • •••• • ••• • •••• • ••• • •••• • ••• • •••• • ••• • •••• • ••• • •••• • • • • • •••• • ••• • •••• • ••• • ••• • •••• • ••• • ••• • •••• • ••• • •••• • ••• • •••• • ••• • •••• • ••• • •••• • ••• • •••• • • • • • •••• • ••• • •••• • ••• • •••• • ••• • • •• • • • • • • •••• • • •• • •••• • ••• • •••• • • •• • •••• • ••• • •••• • ••• • •••• • ••• • •••• • • •• • •••• • • •• • •••• • ••• • •••• • ••• • •••• • ••• • •••• • ••• • •••• • • •• • •••• • • • • • • •• • • • ••• • •••• • • •• • •••• • • •• • •••• • ••• • ••• • • • •• • •••• • ••• • •••• • • •• • •••• • ••• • •••• • • •• • •• •• • ••• • •••• • ••• • •••• • • • • • •••• • ••• • •••• • ••• • •••• • ••• • •••• • • • • • •••• • ••• • • • • • • ••• • •••• • ••• • •••• • ••• • • •• • •••• • ••• 164



LED Cinema Display, 2010 165



169

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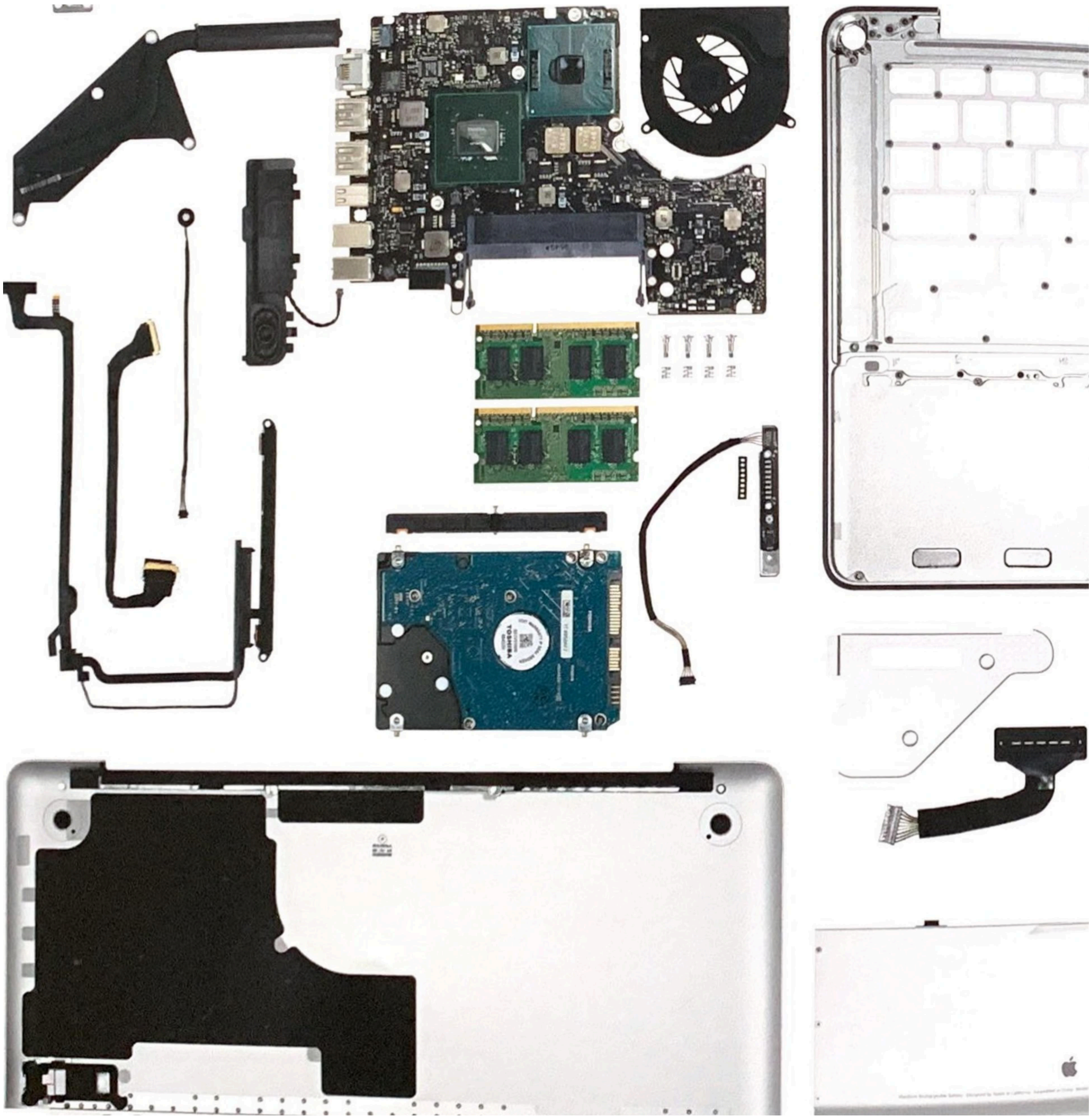
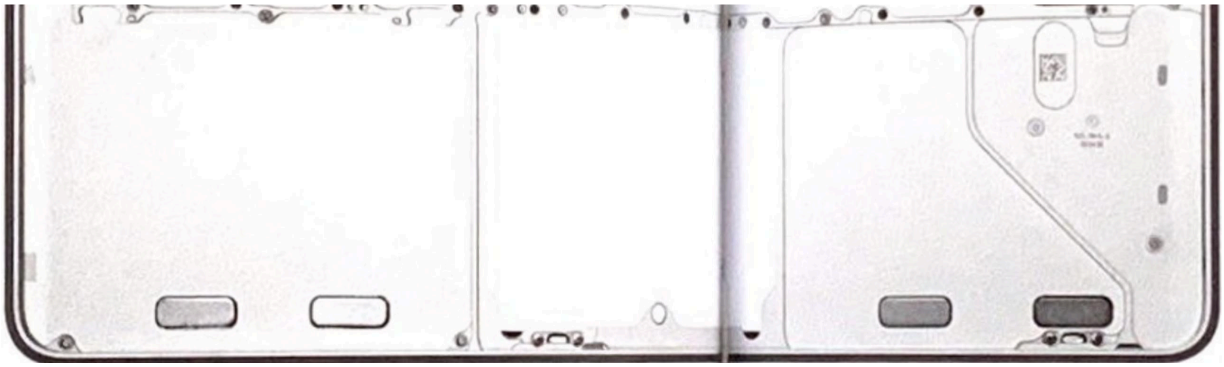
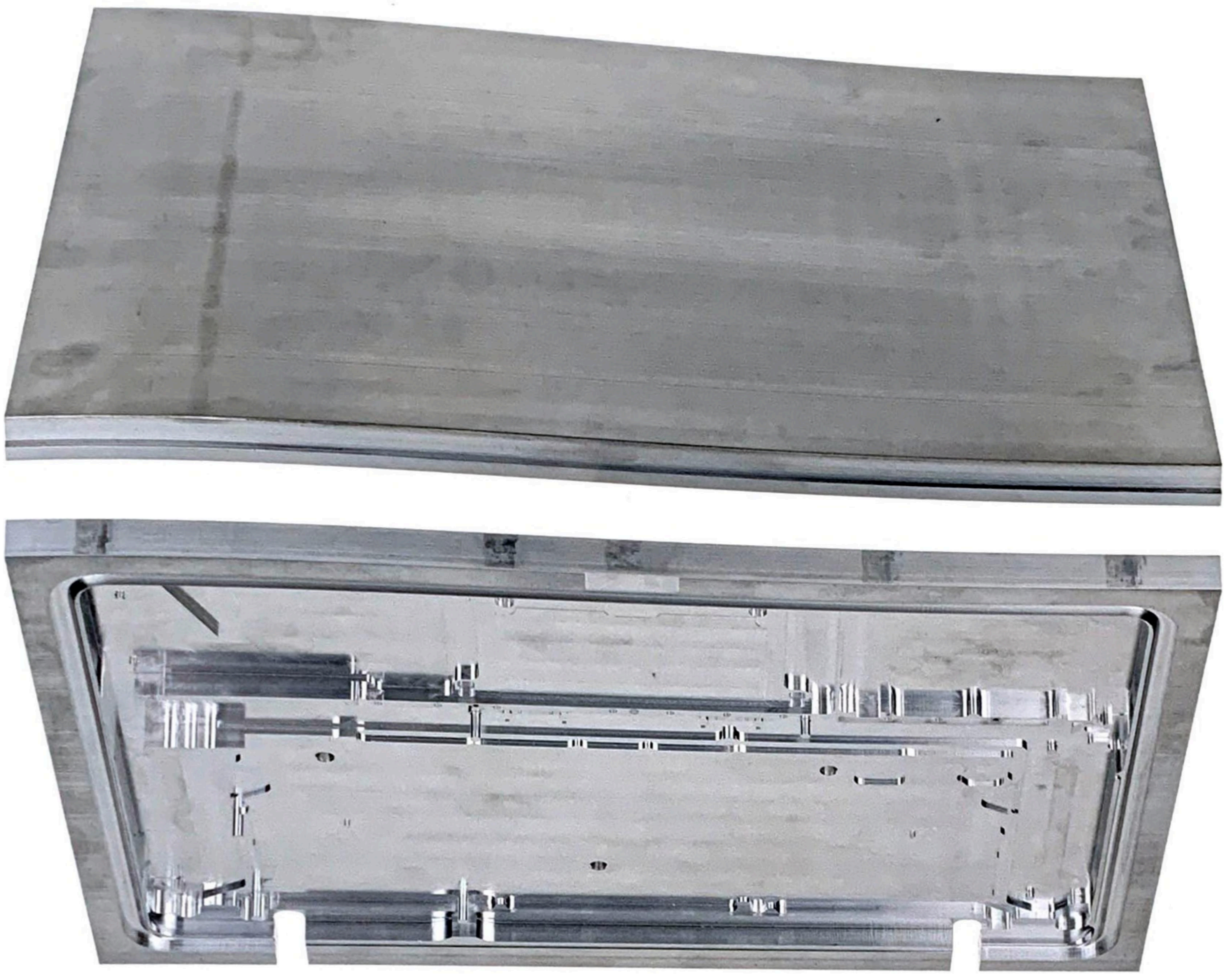
CZD CZ) F-fcTl «ll 170 171







iPod shuffle, 2009 174

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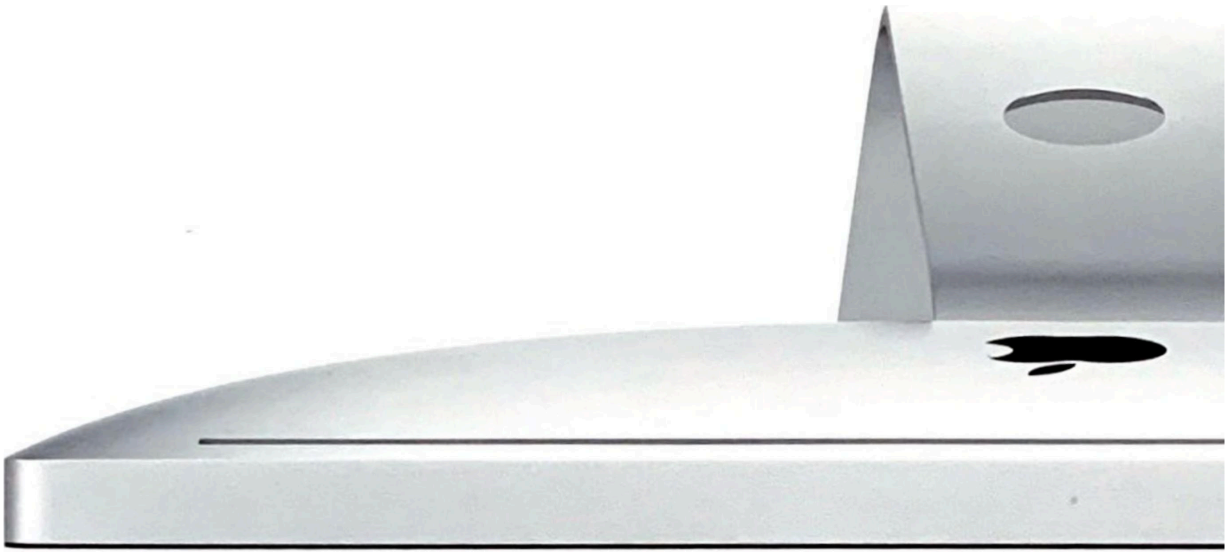
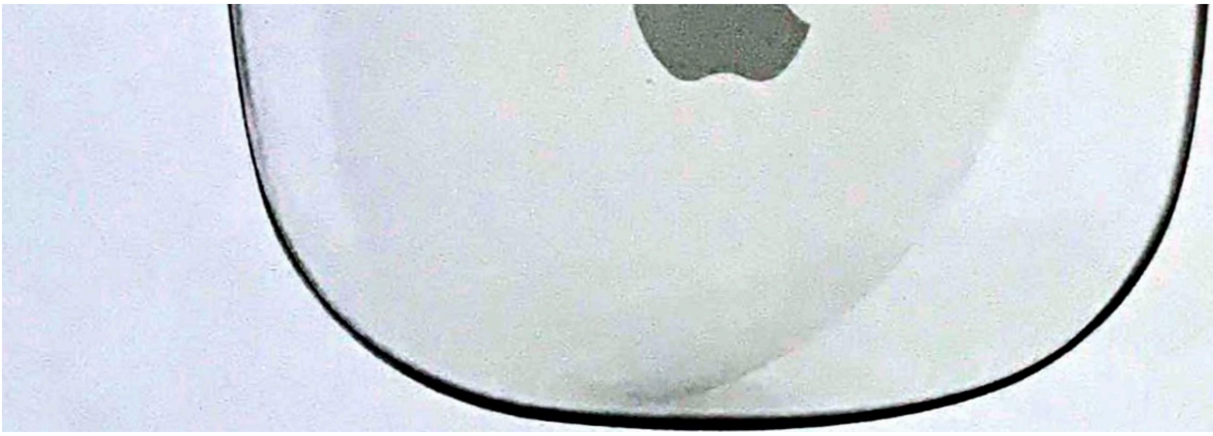


Mouse, 2009 178


Rechargeable
Rechargeable



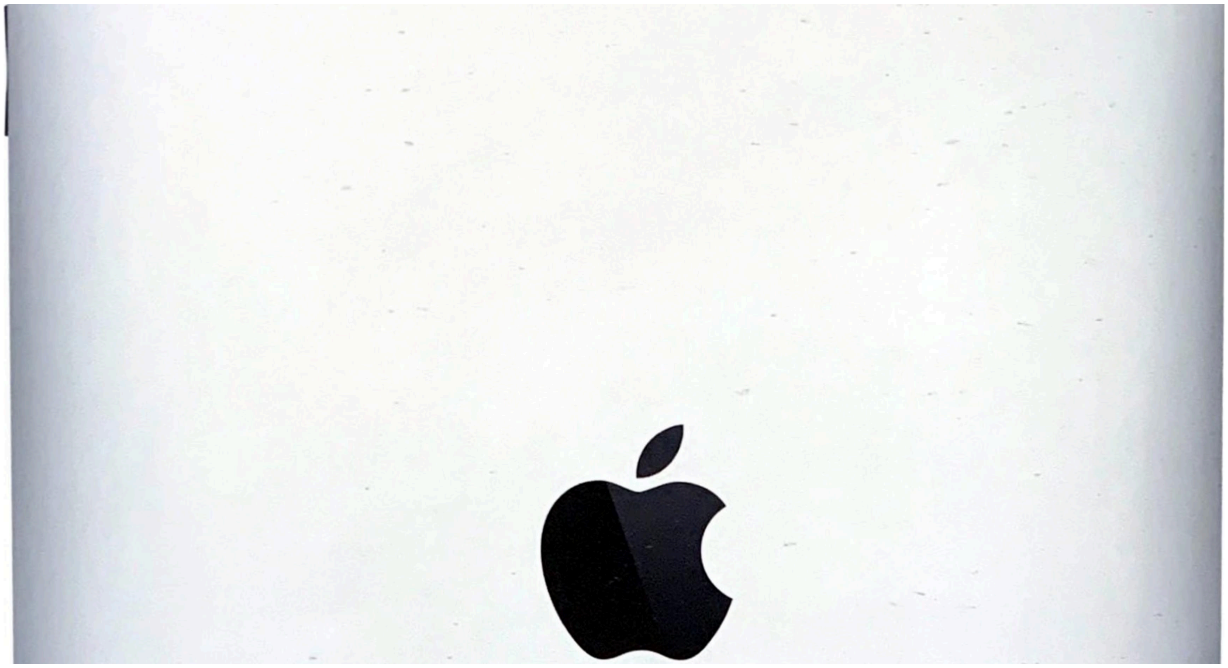
MacBook, 2009 180


MENU

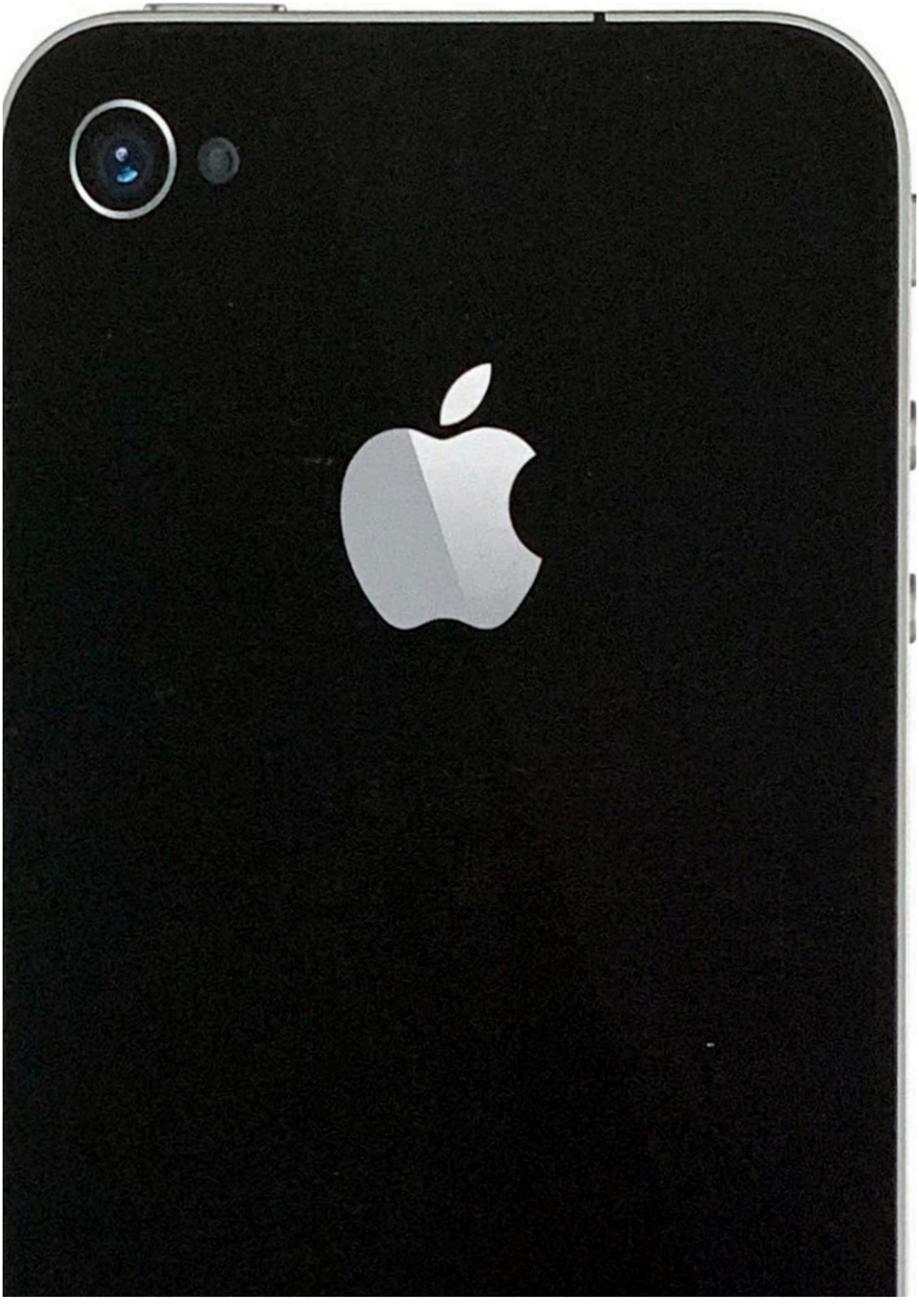
iPod 183

' ua, '09 184

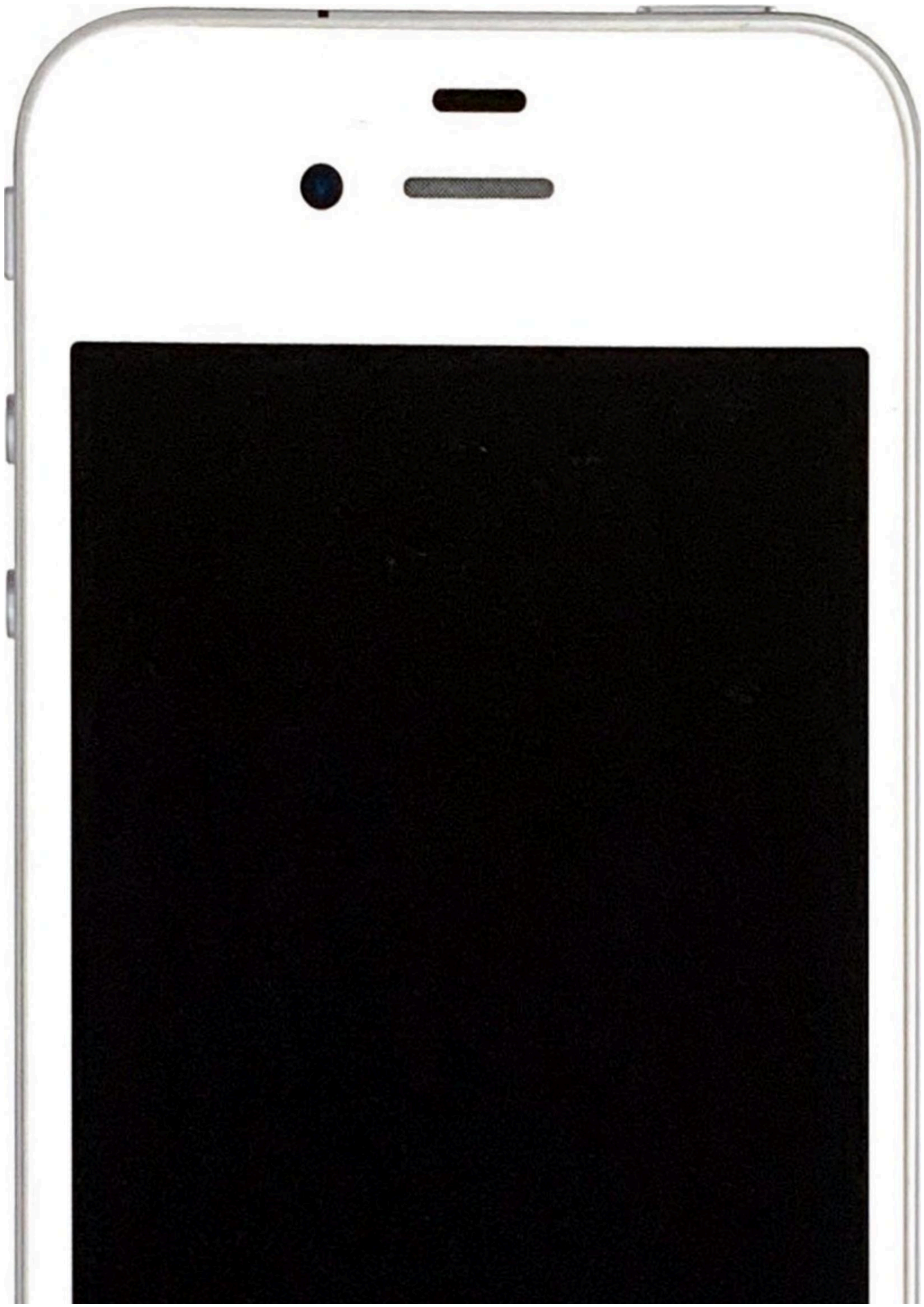
I iPad 185

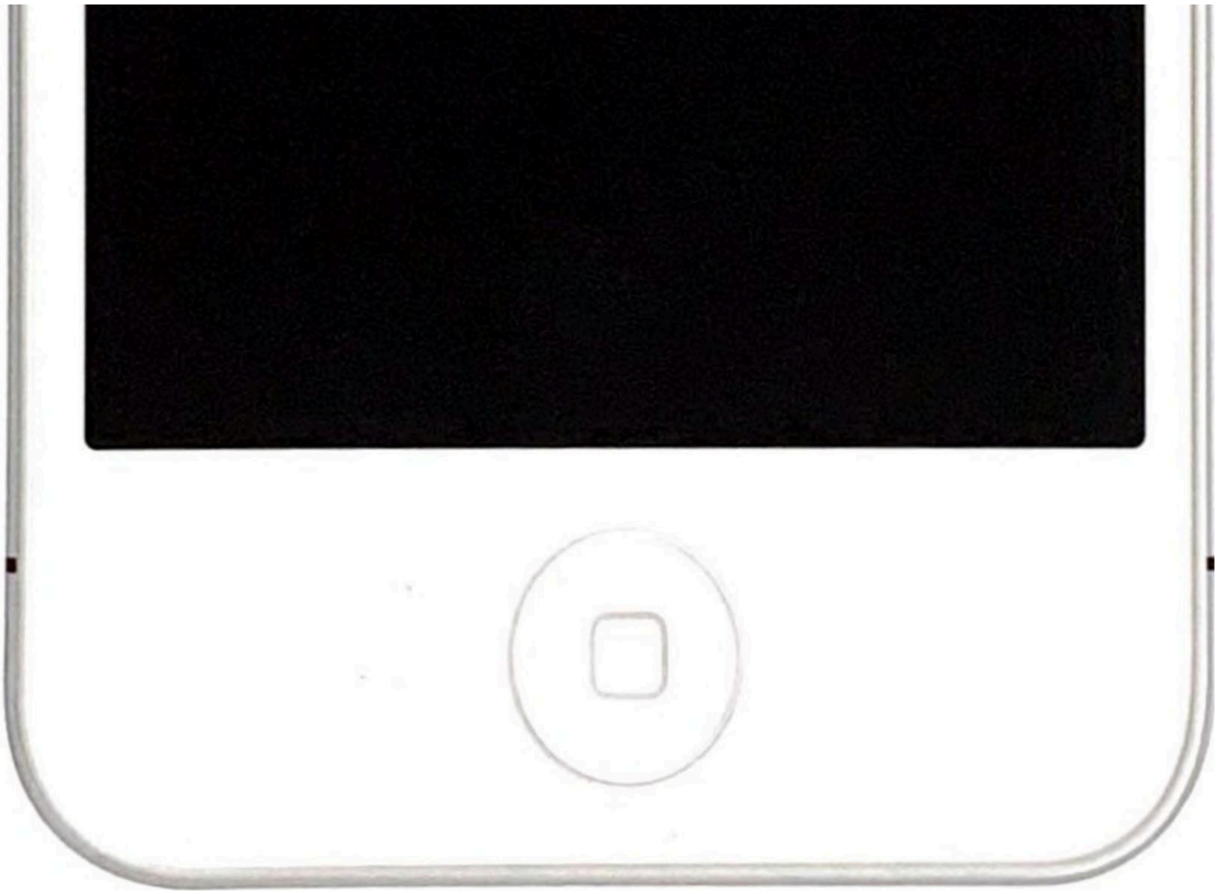


iPhone 4, 2010 186




iPhone
Designed by Apple in California Assembled in China
Model A1332 EMC 380A FCC ID: BCG-E2380A IC: 579C-E2380A
0682





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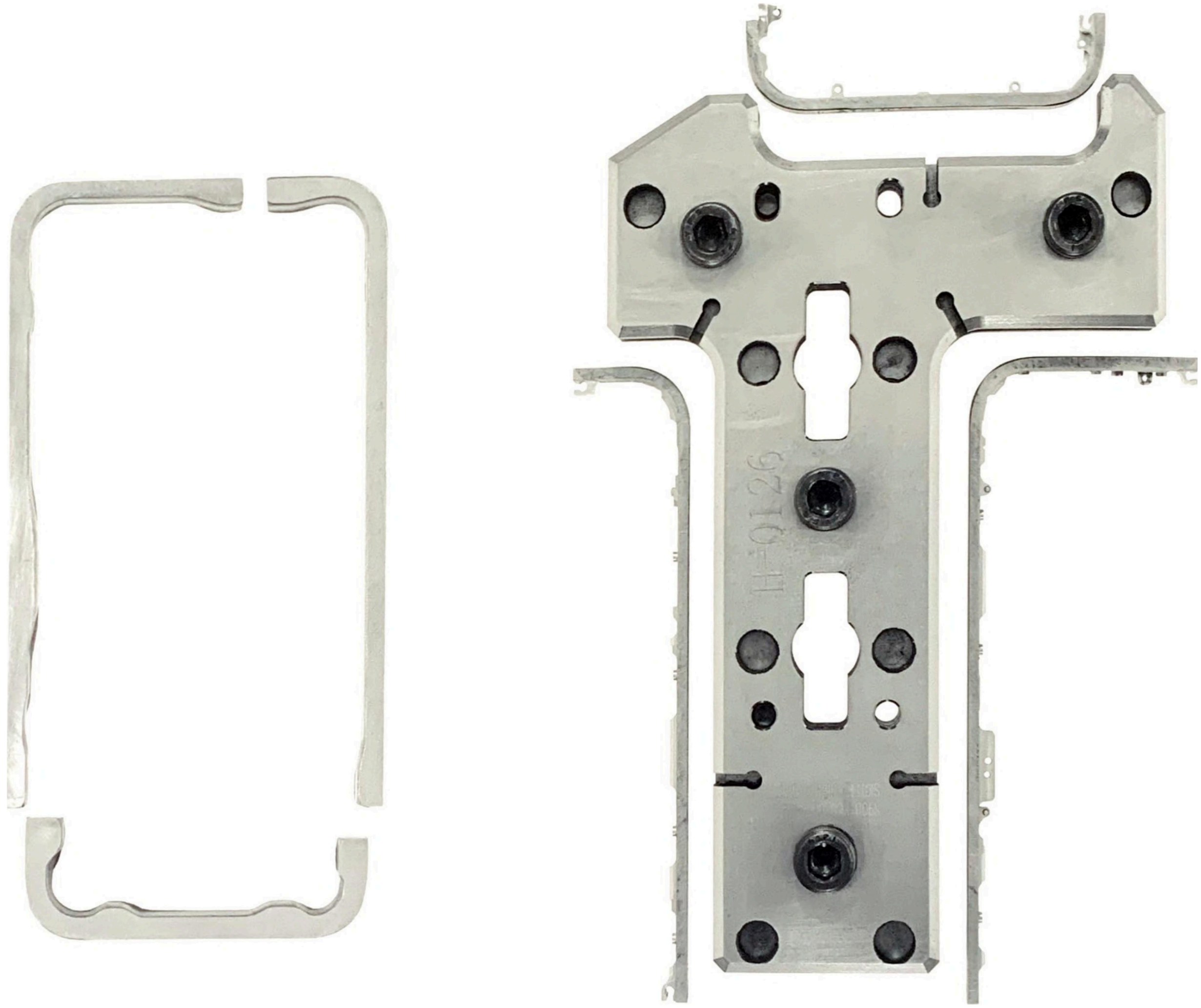

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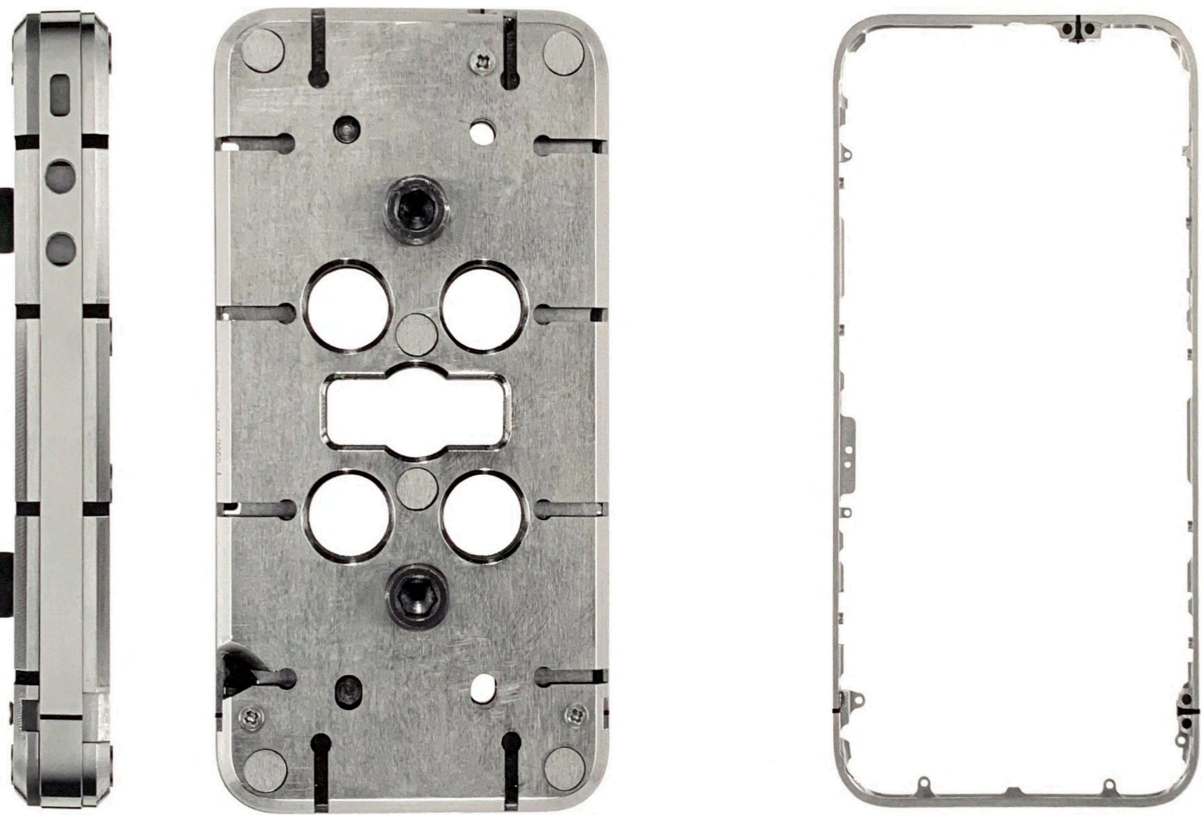

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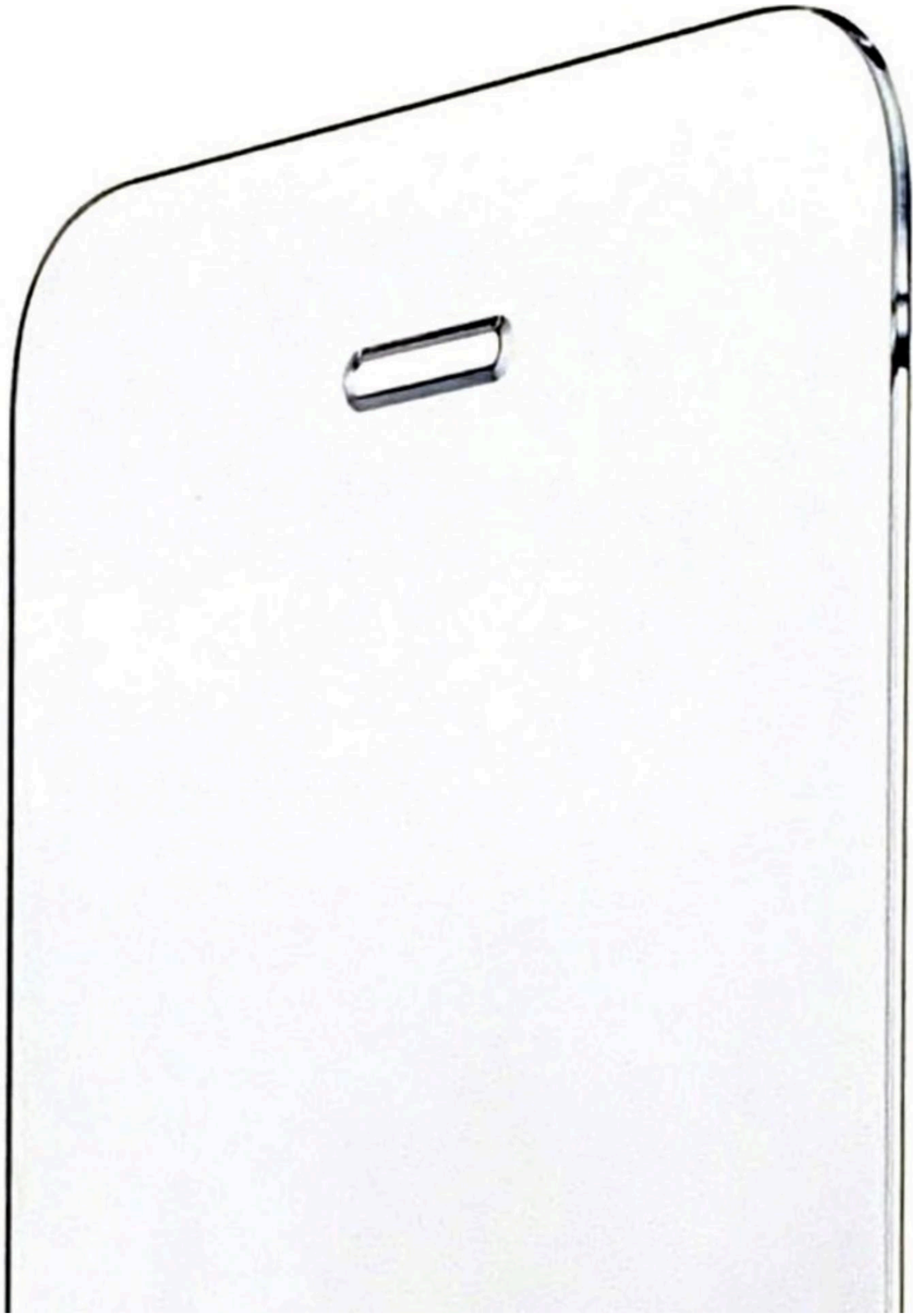
191



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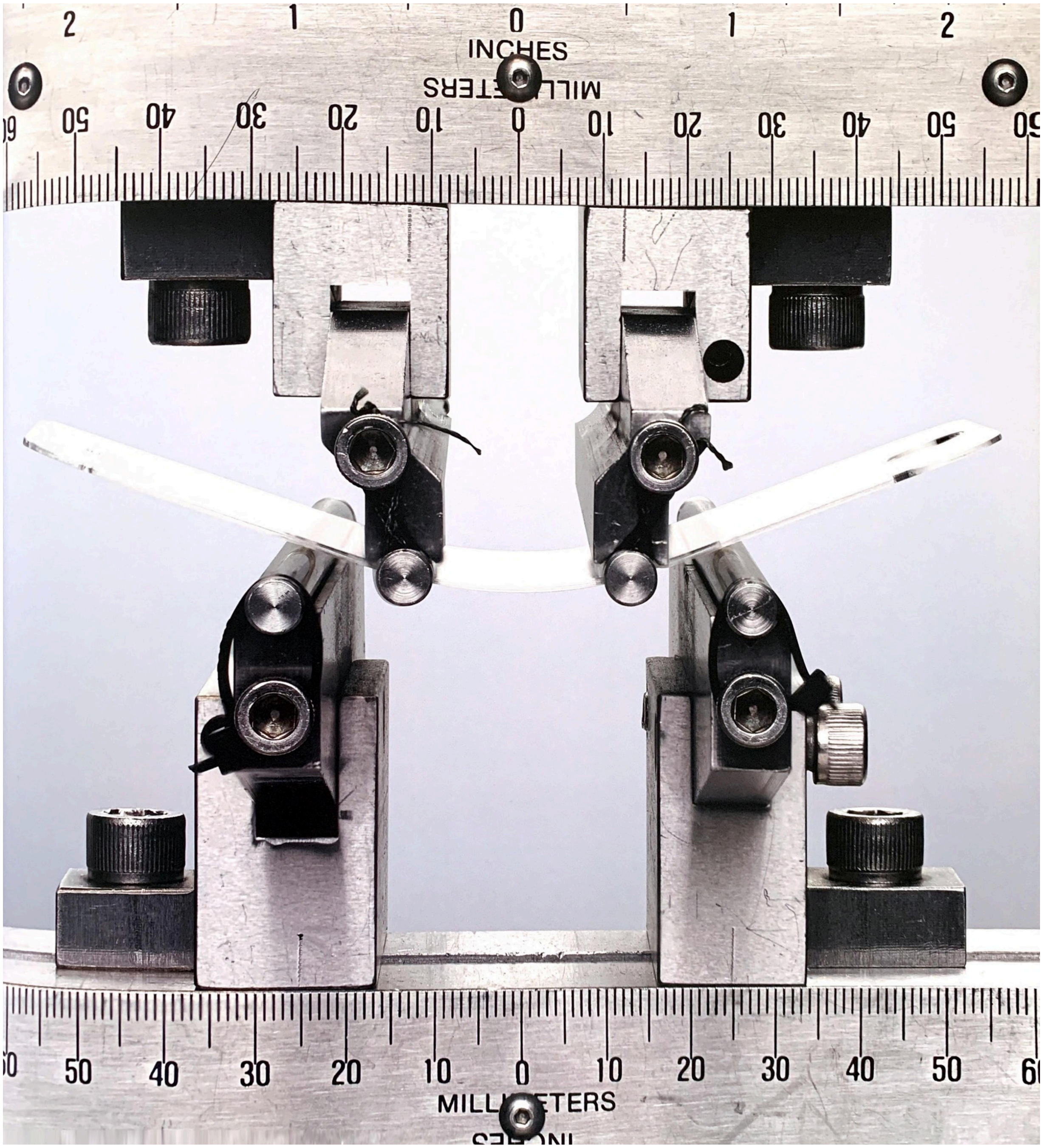

iPhone 4 Bumpers 195

Mac mini, 2010 196

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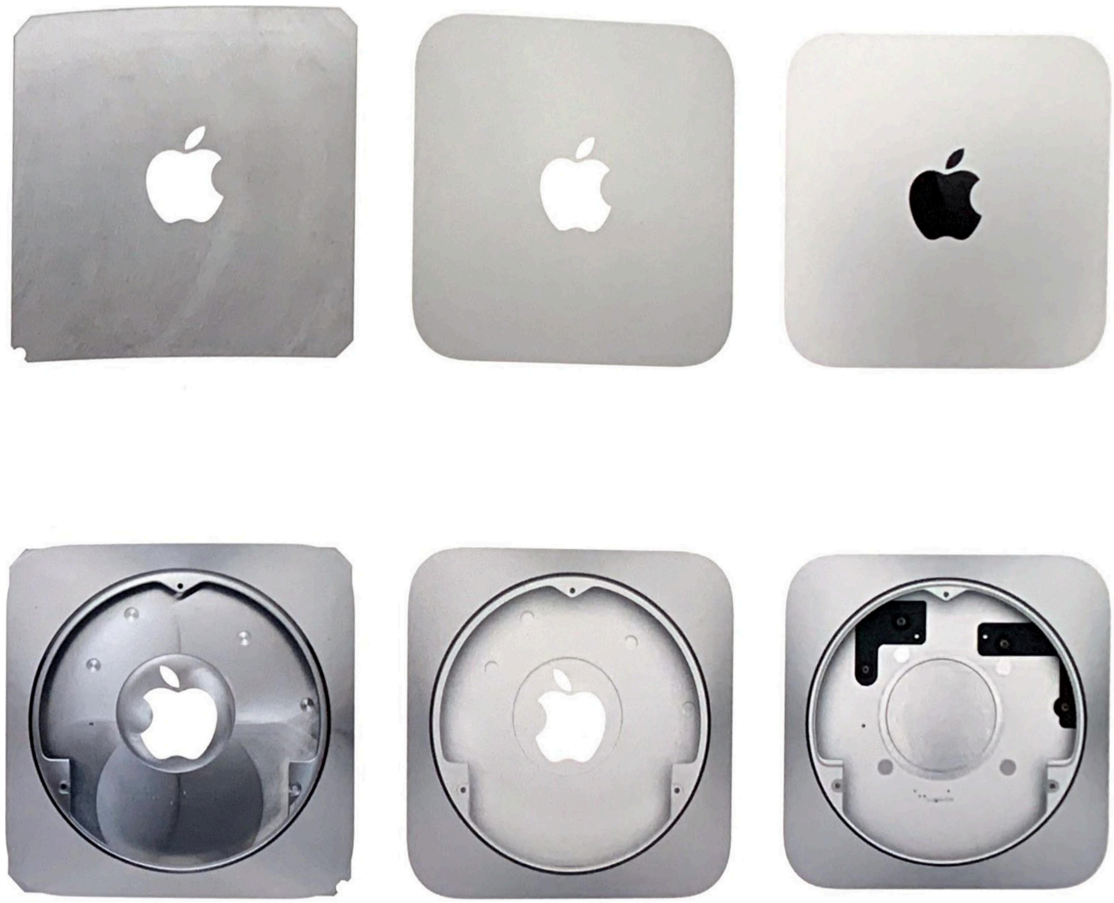
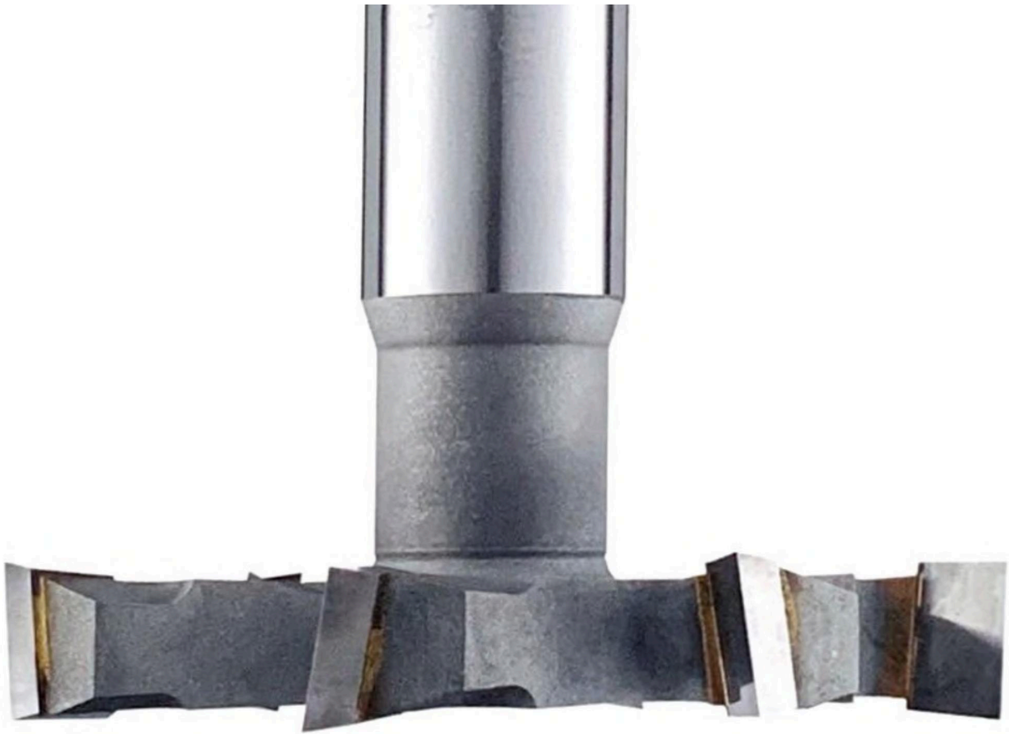
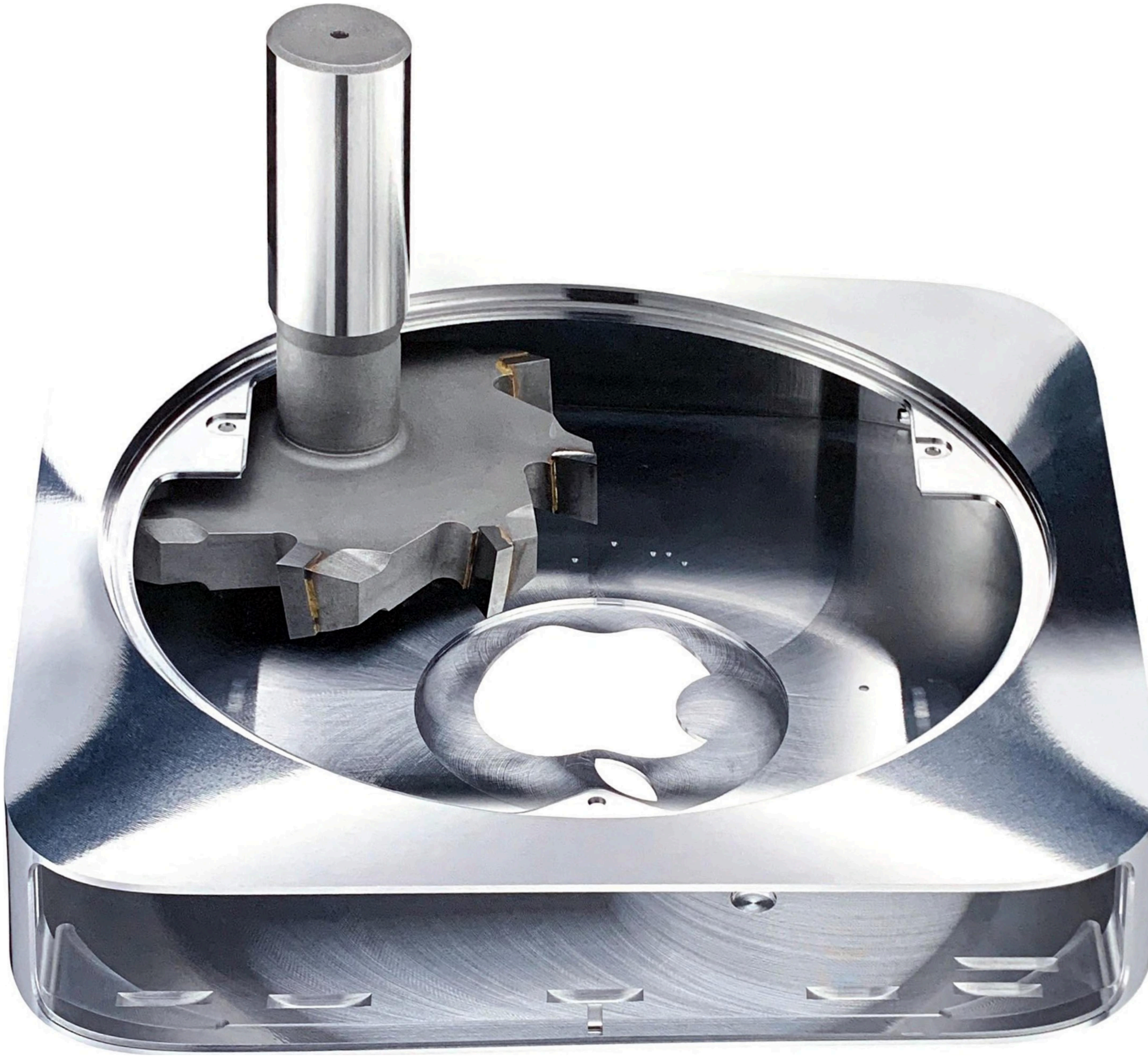
199

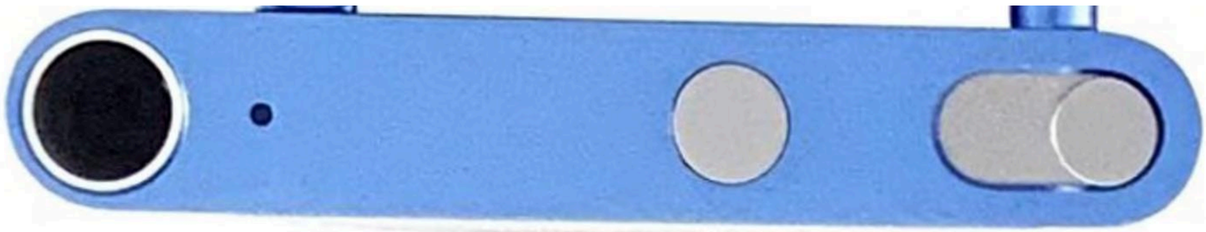






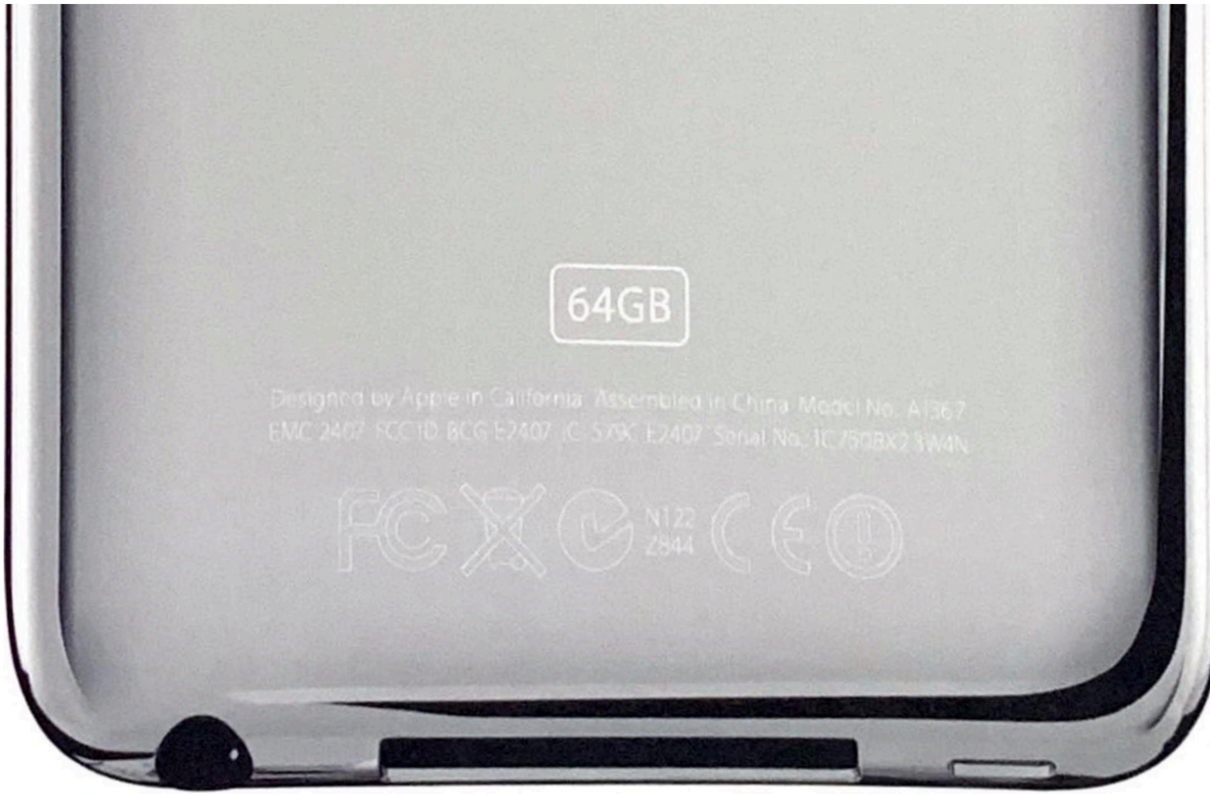
iPod nano, 2010 202

iPod shuffle, 2010 203



iPod touch, 2010 204


iPod


64GB
Designed by Apple in California Assembled in China Model No. A1367
N122
Z844

Apple TV. 2010 206

207

Apple Remote, 2010 208

MacBook Air, 2010 210

iPad 2, 2011 212

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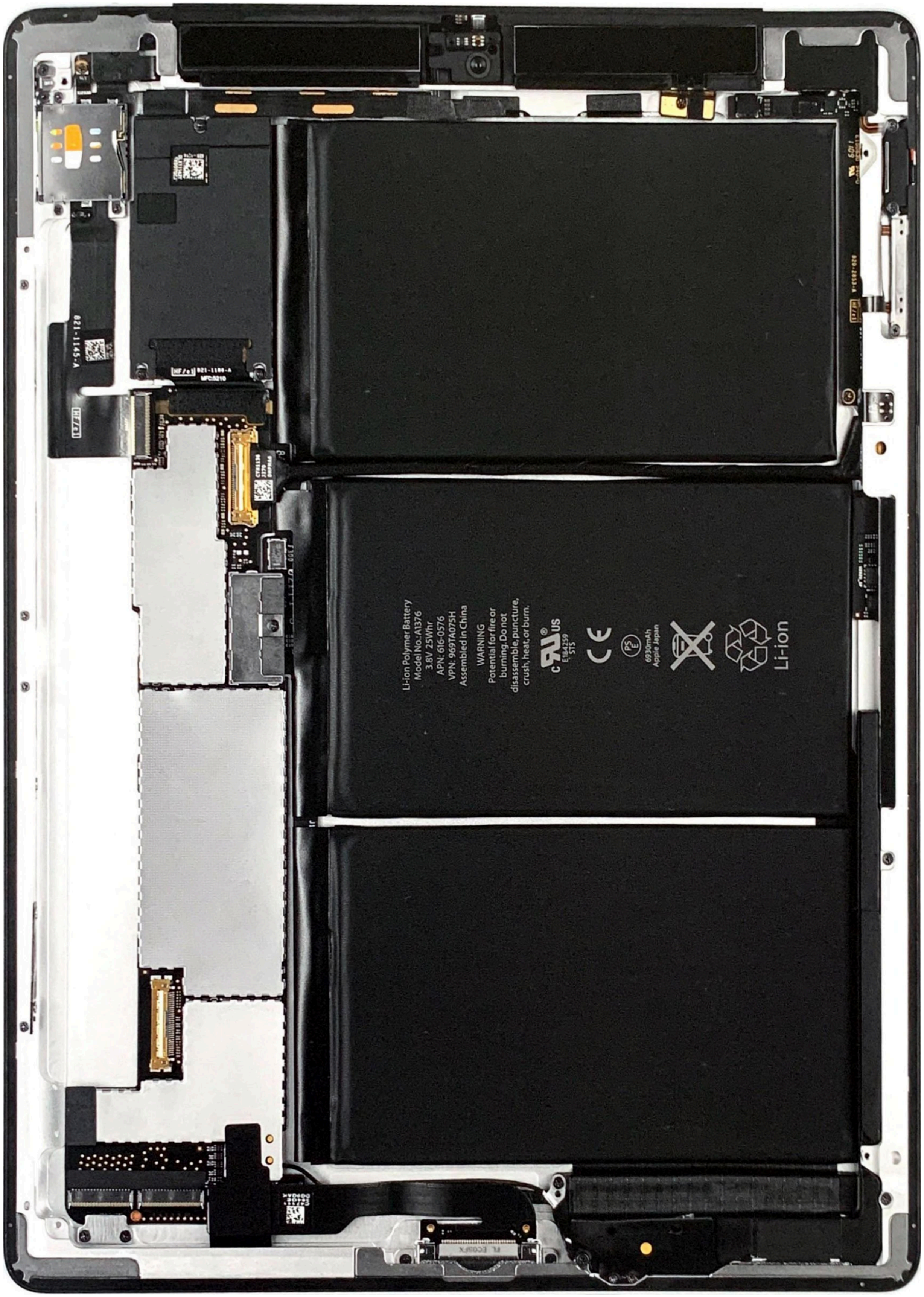
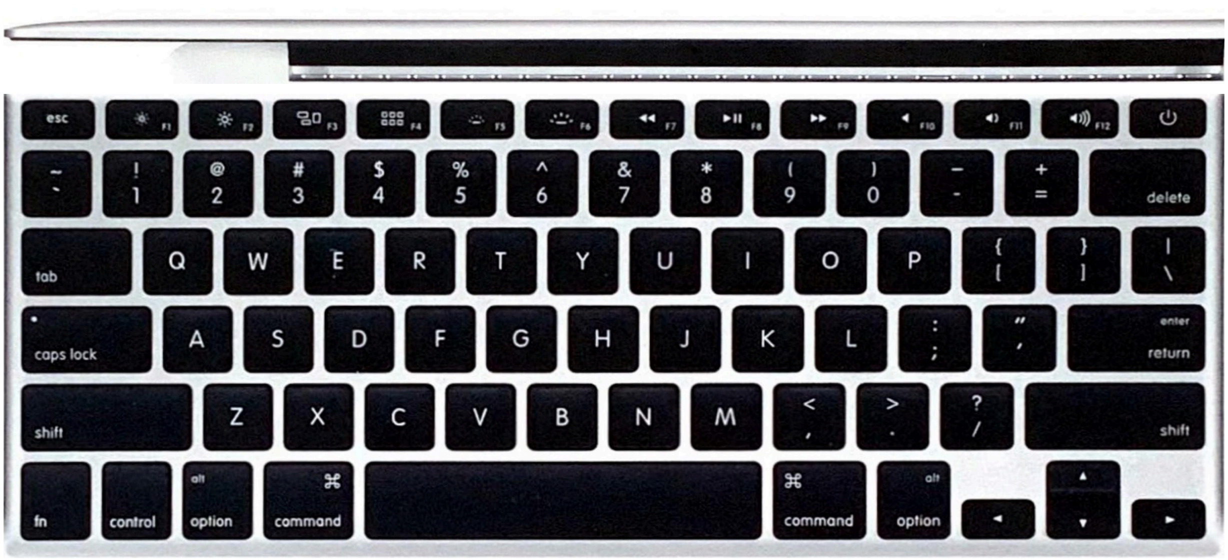
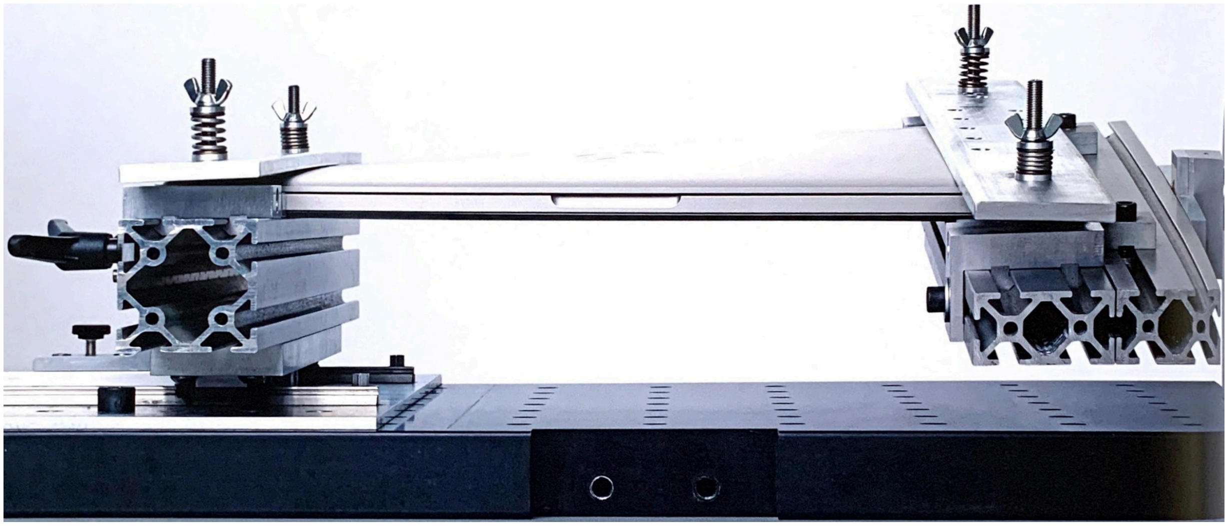
213


Li-ion Polymer Battery
Model No.:A1376
3.8V 25Whr
APN: 616-0576
VPN: 969TA075H
Assembled in China
WARNING
Potential for fire or burning. Do not disassemble, puncture, crush, heat, or burn.
E184259
STS
6930mAh
Apple Japan
Li-ion

iPad 2 Smart Cover 214

MacBook Pro, 2012 218





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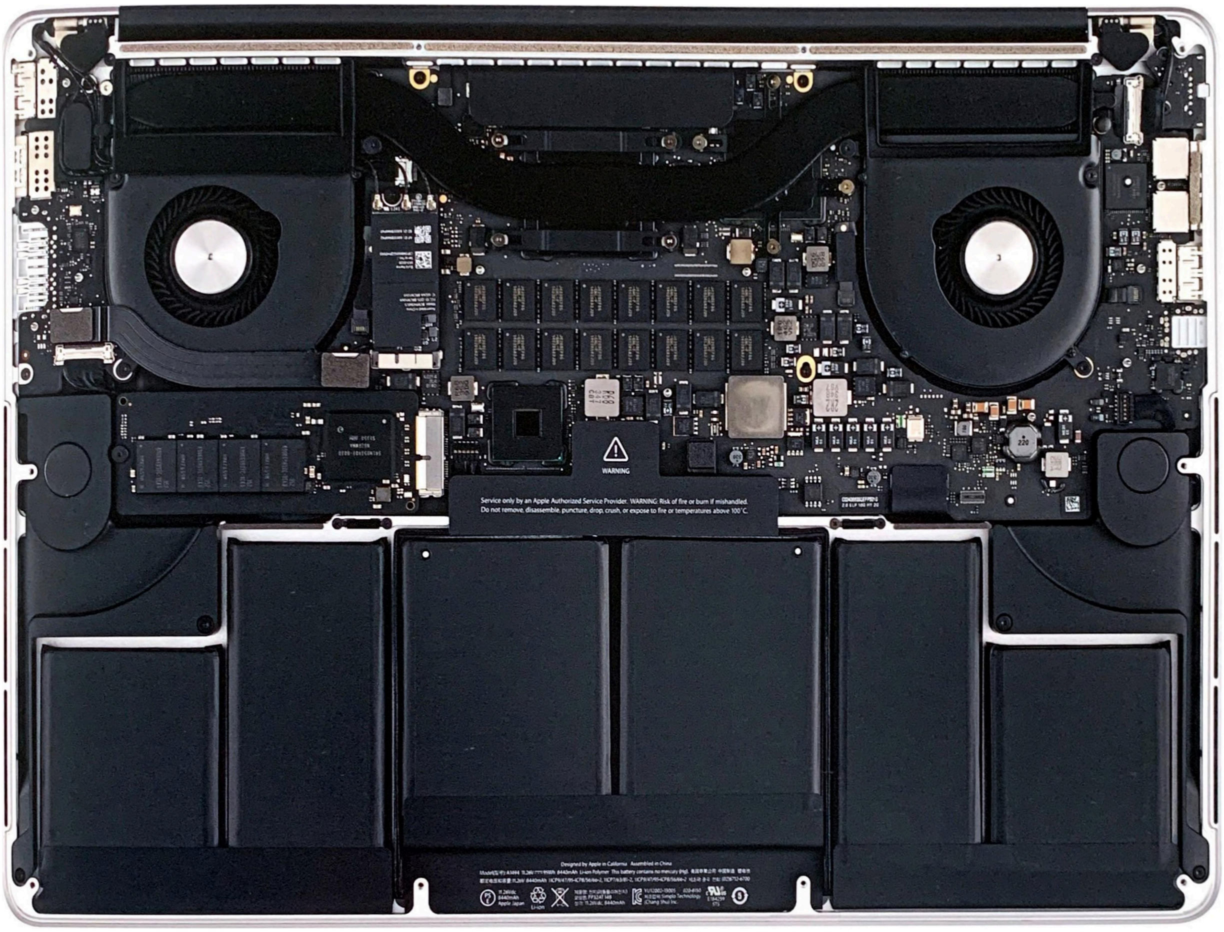

222

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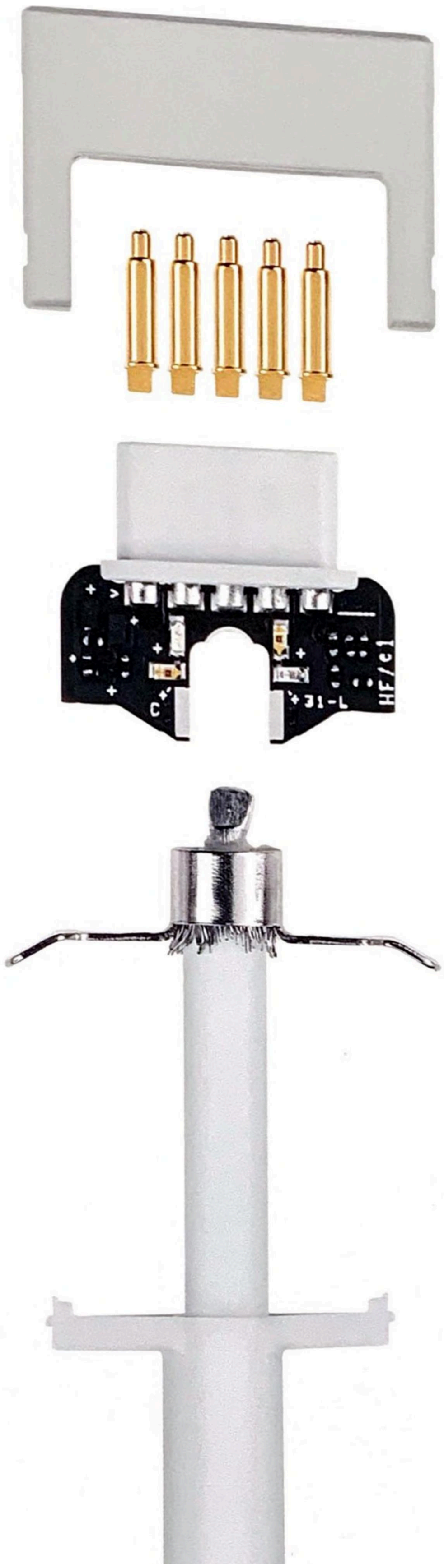
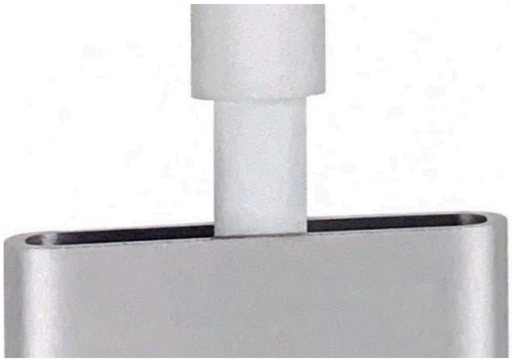
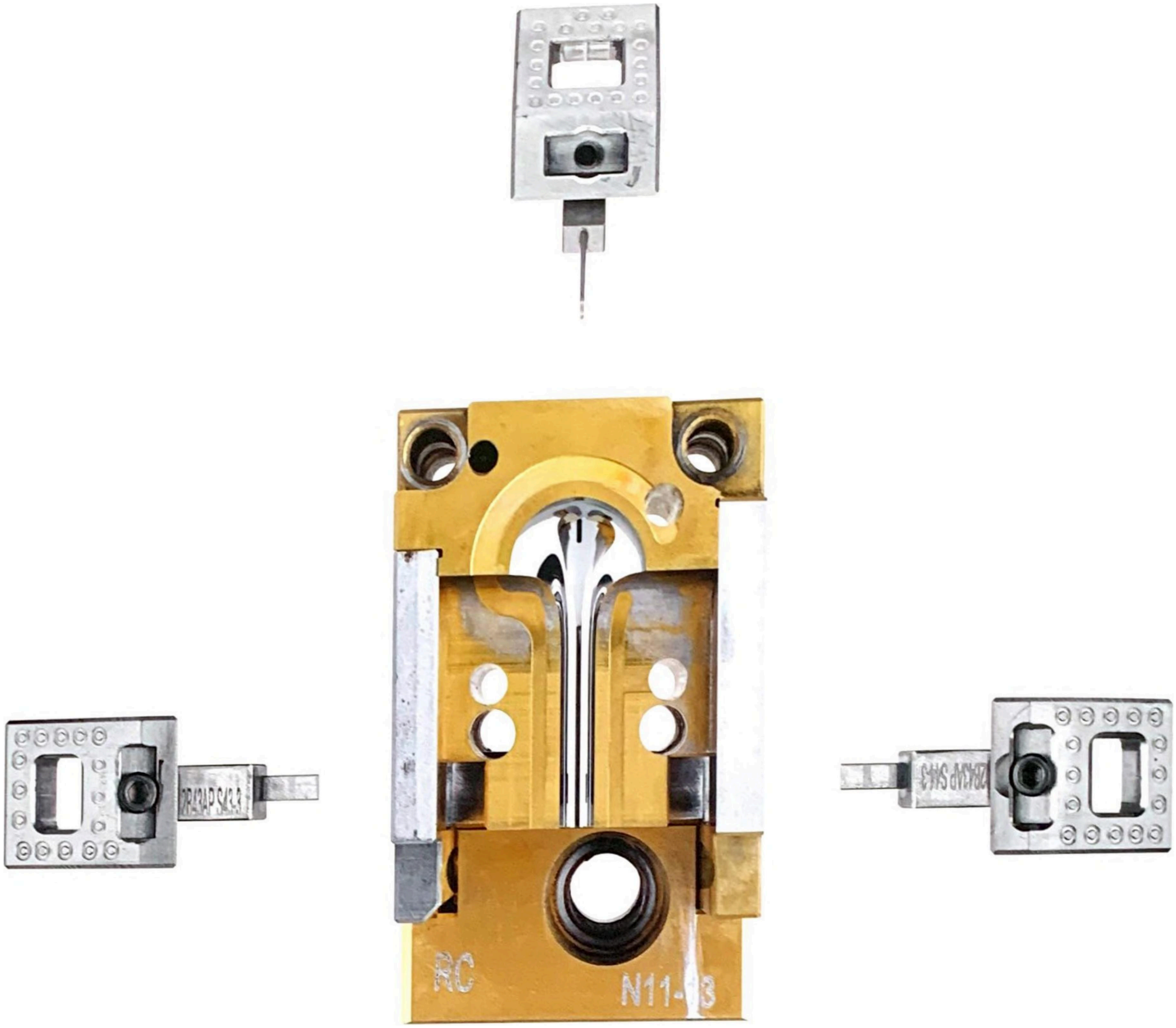




I 227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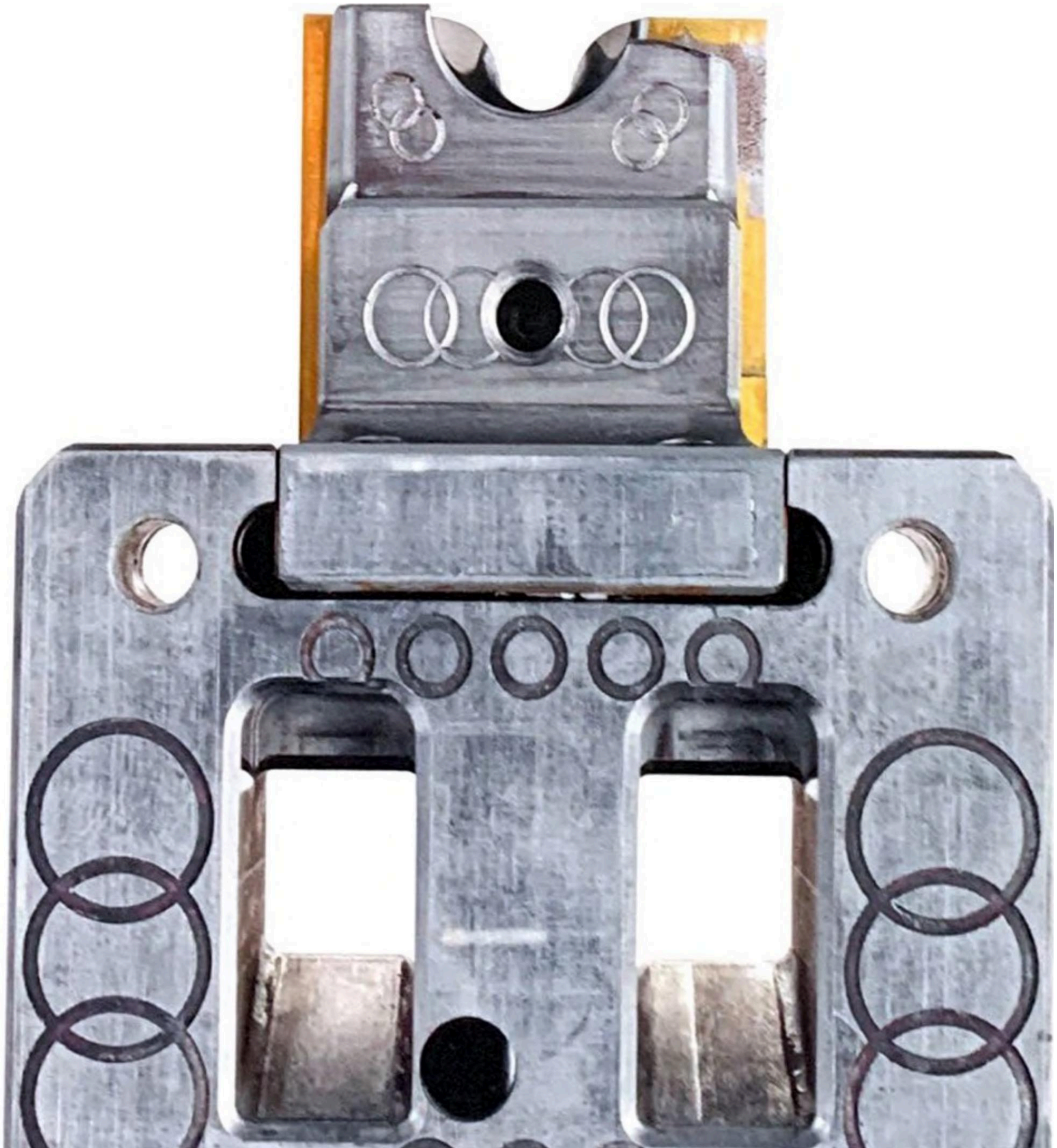


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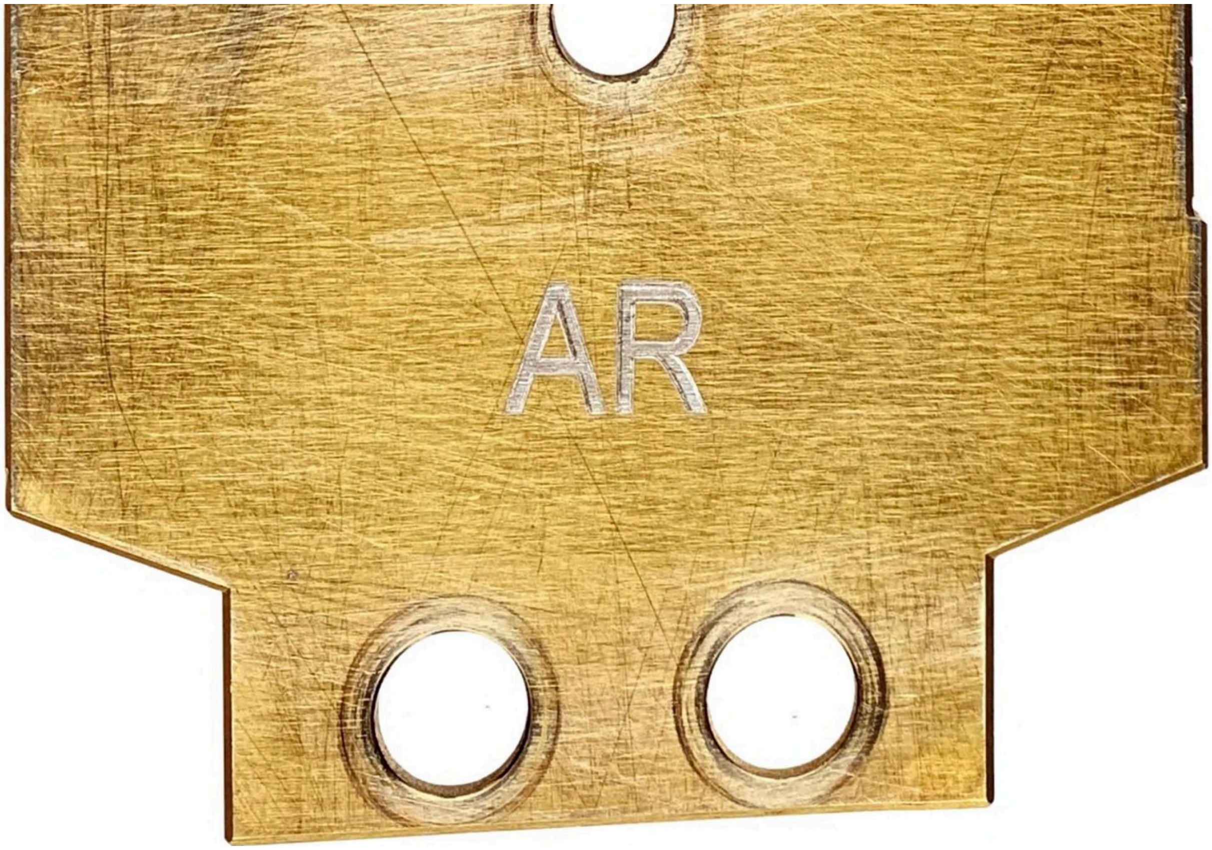

AR

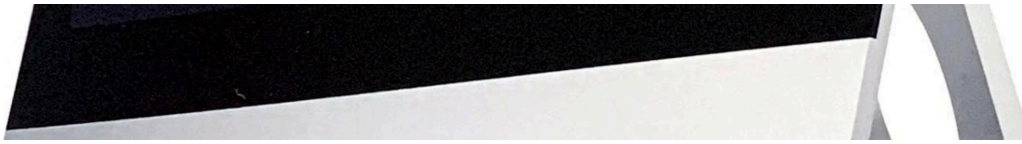
iPod touch, 2012 32

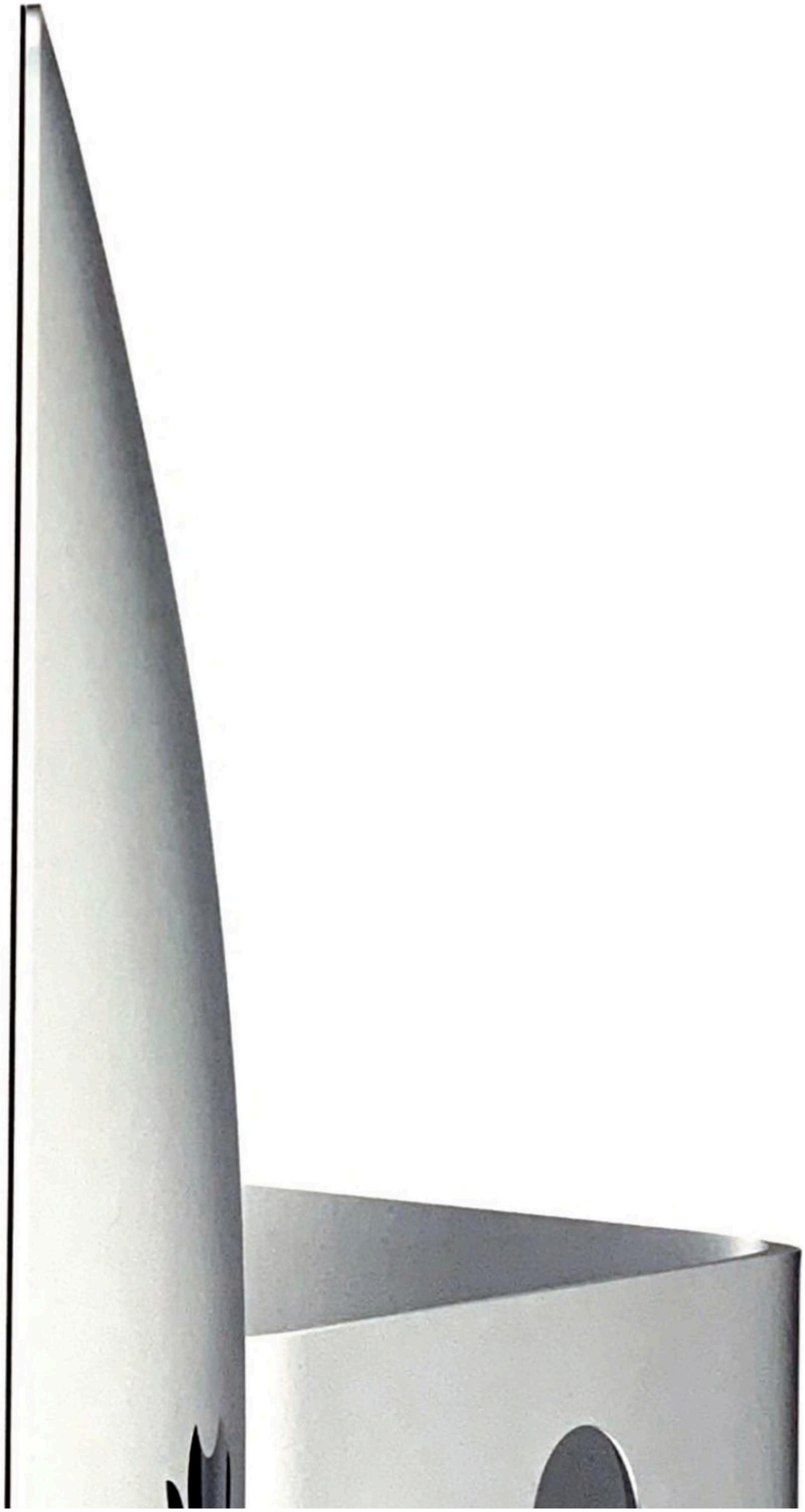

iPod

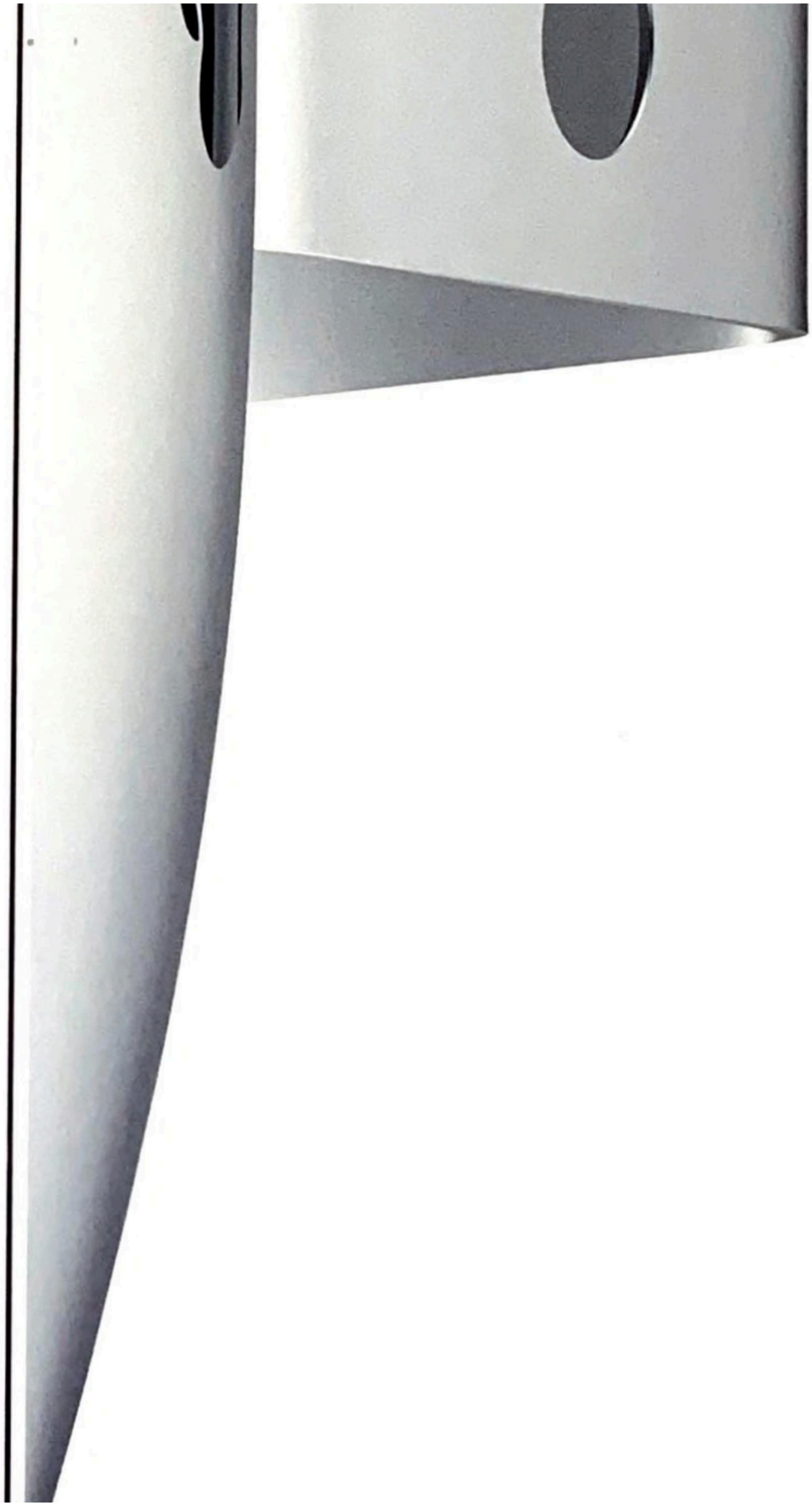

FCC ID: BCG-A1421 IC: 579C-A1421

I '^Tfnn Assembled in China Model A1421 CCID.BCG-A1421 IC:579C-A1421 Serial No.:CCQJM3AZF4JR I f i t I ^ "IP *

iMac, 2012 234







iPhone 5s, 2013 1 239

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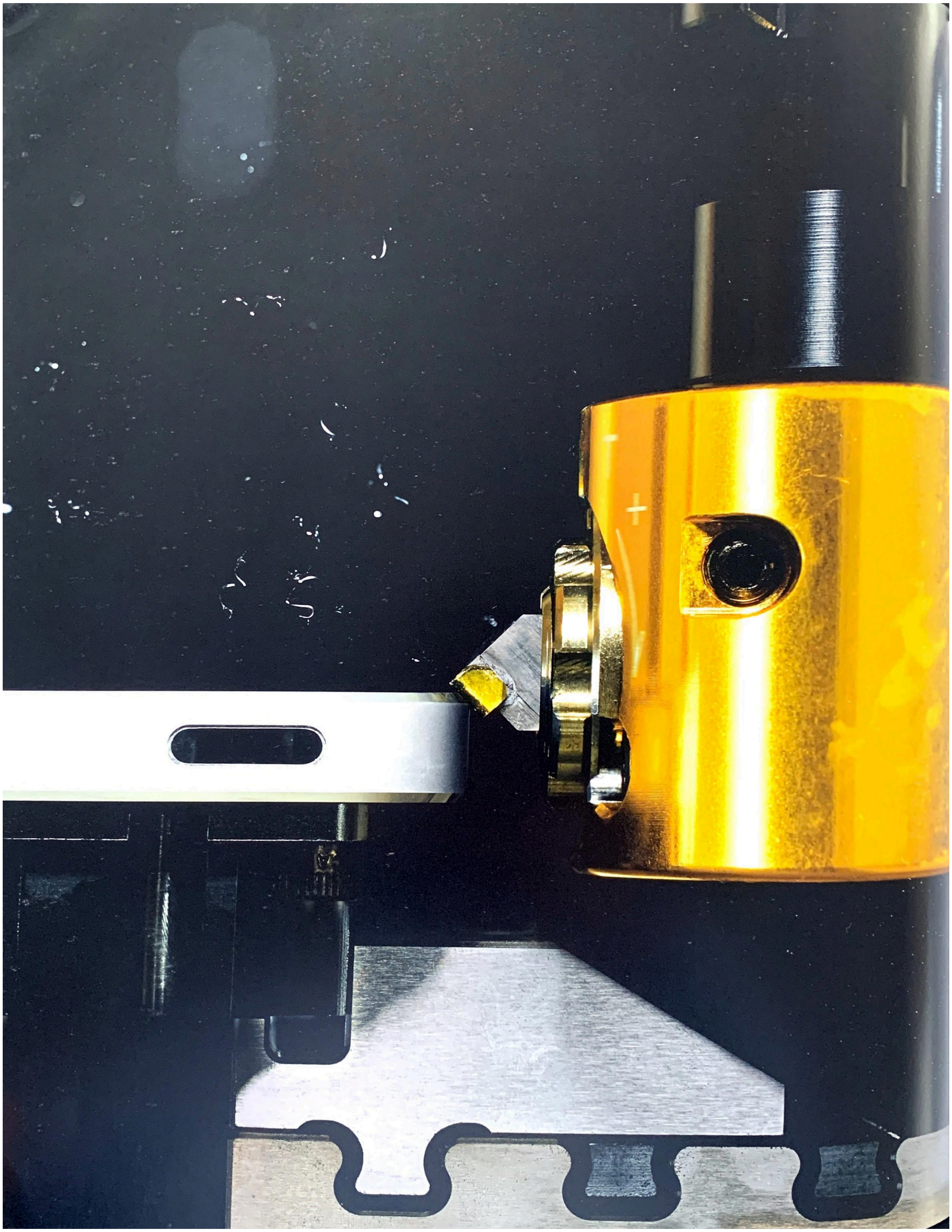
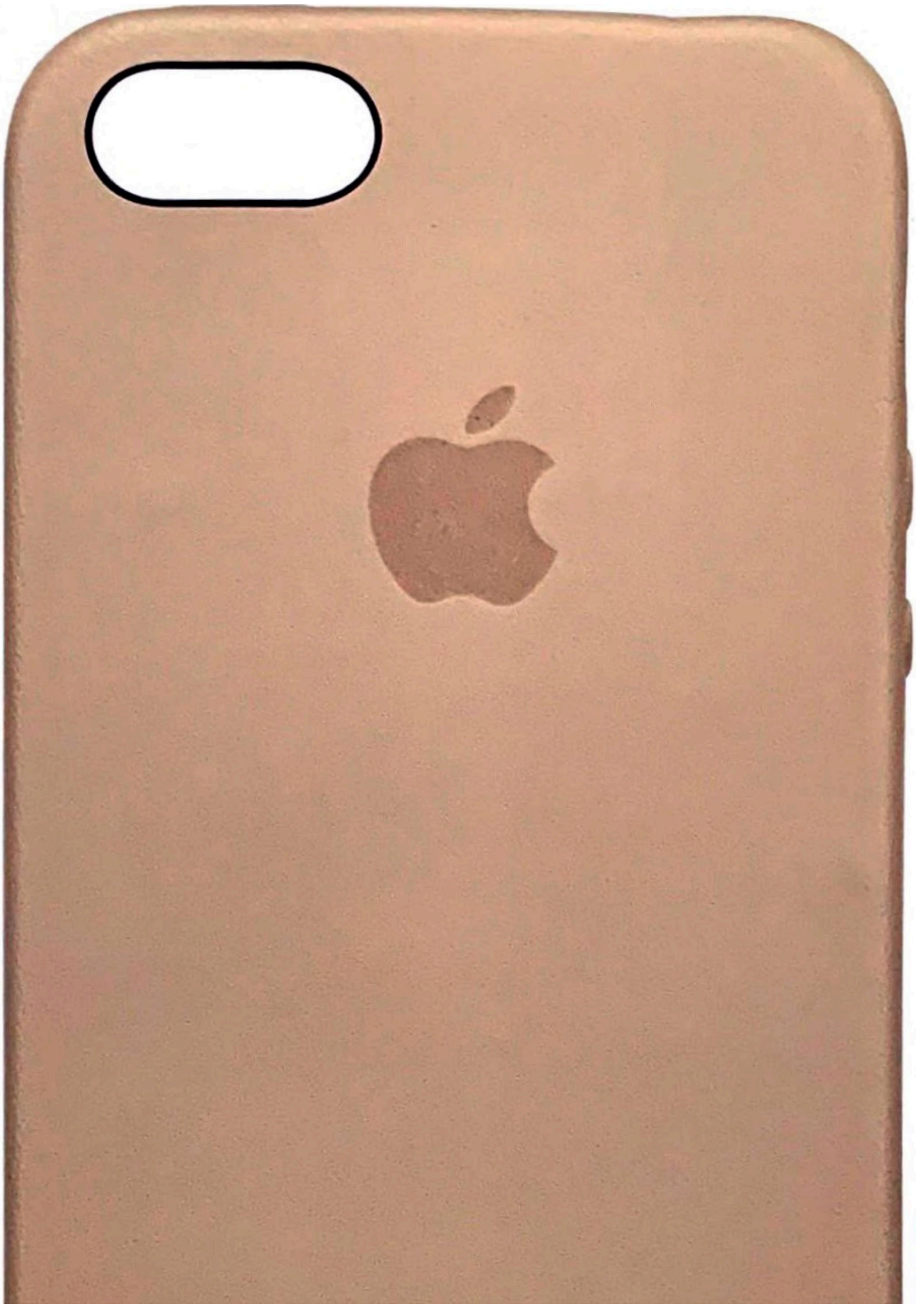
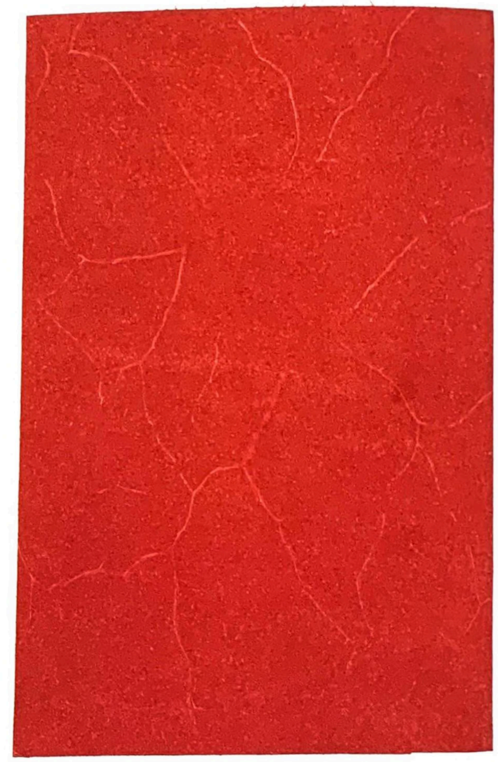
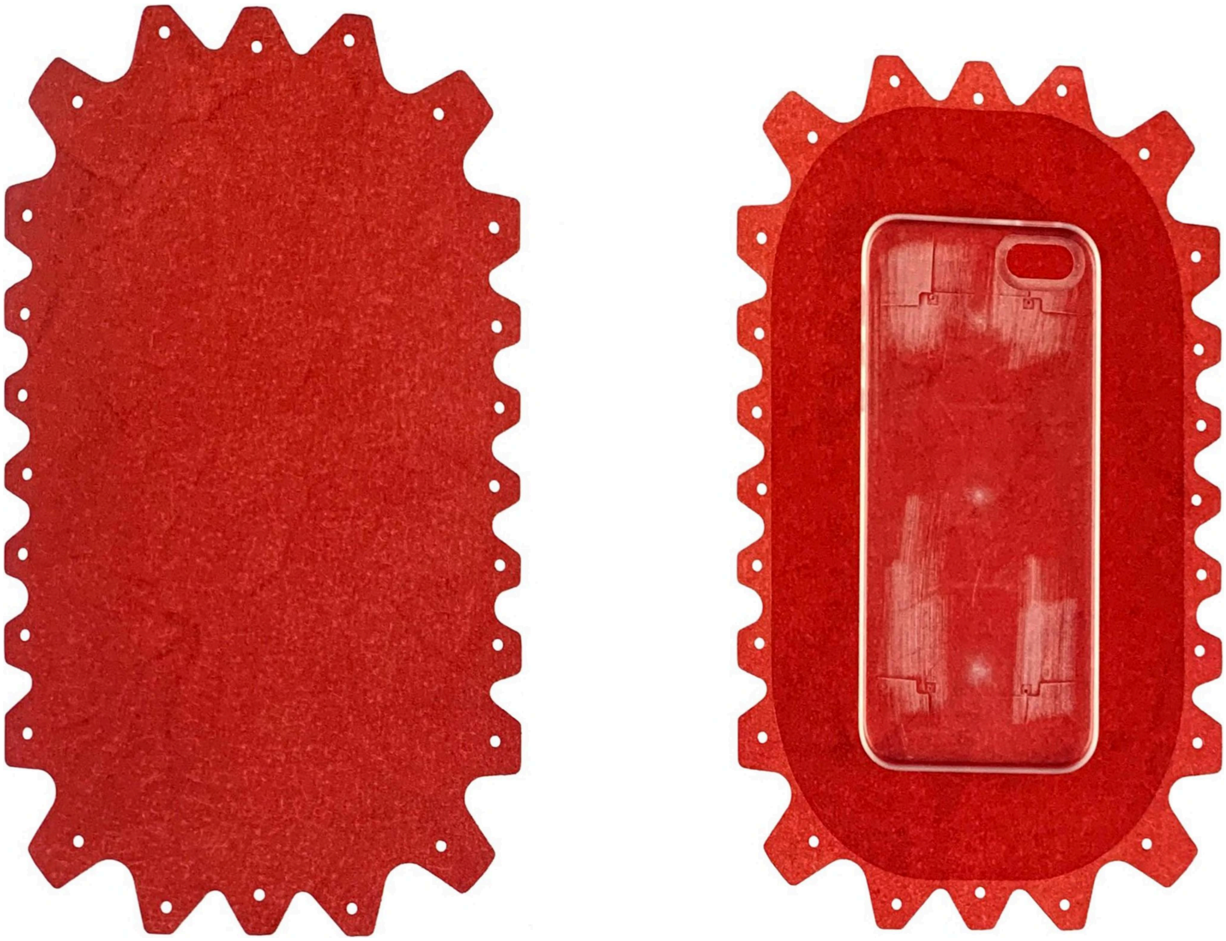
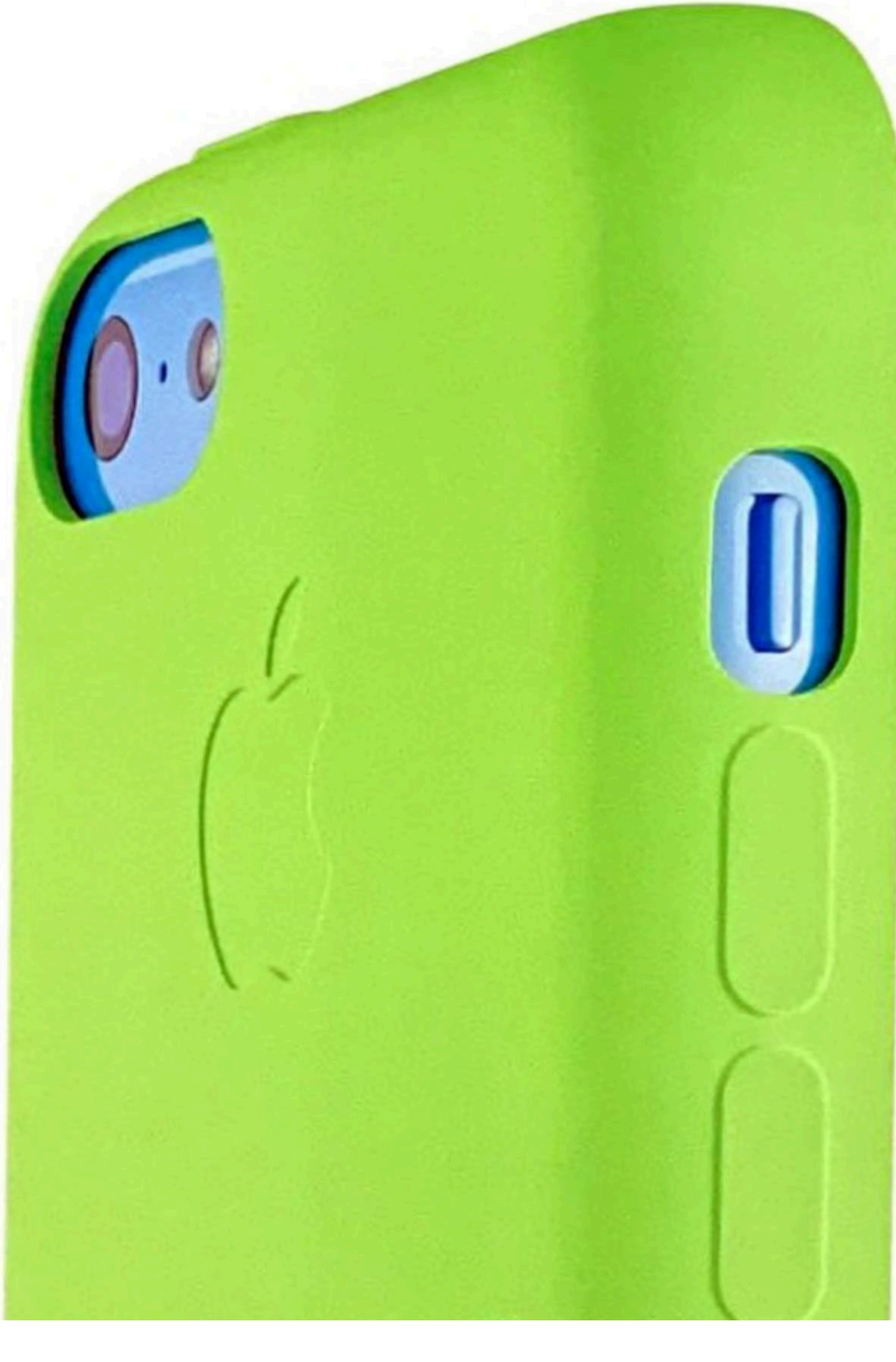


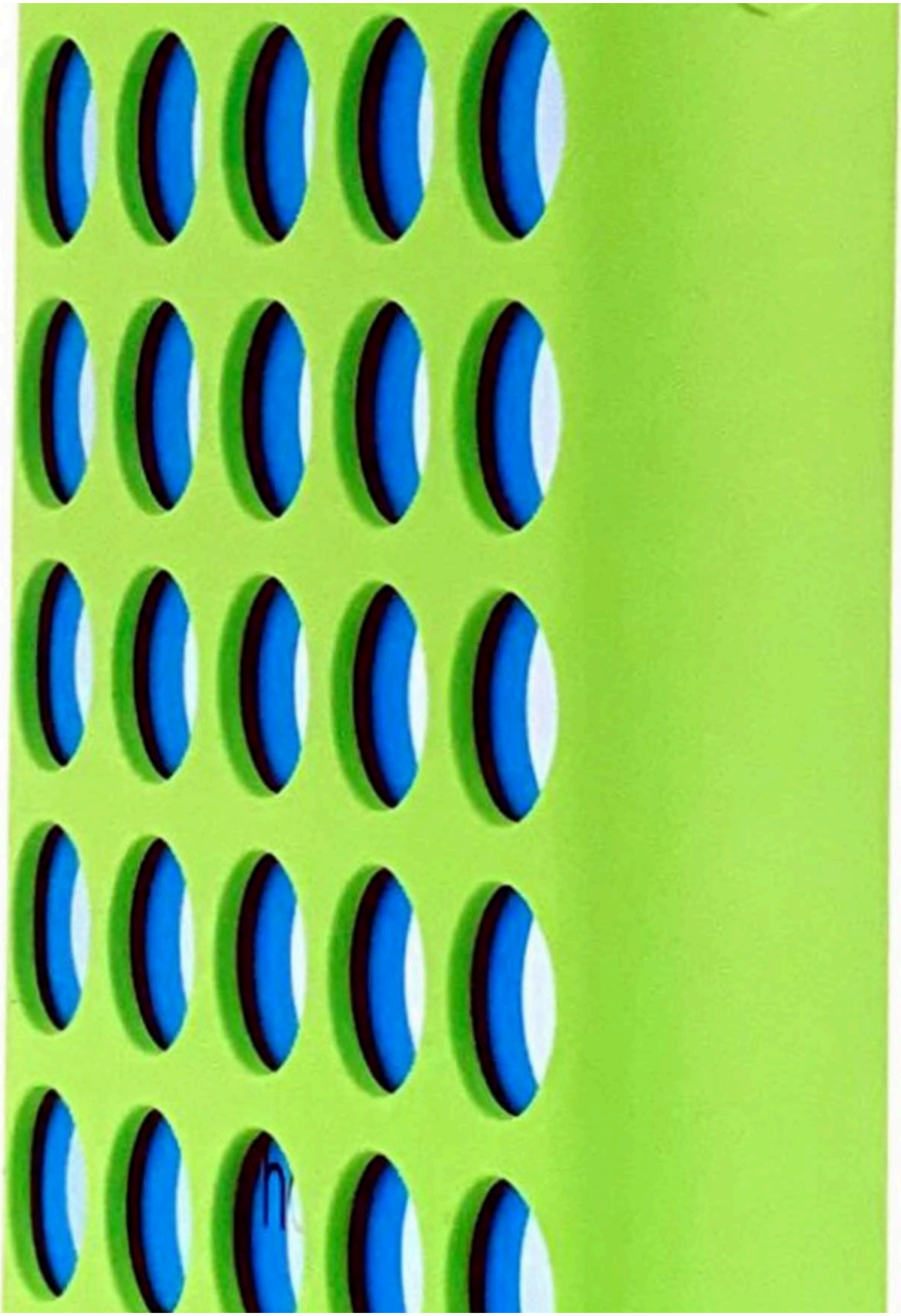






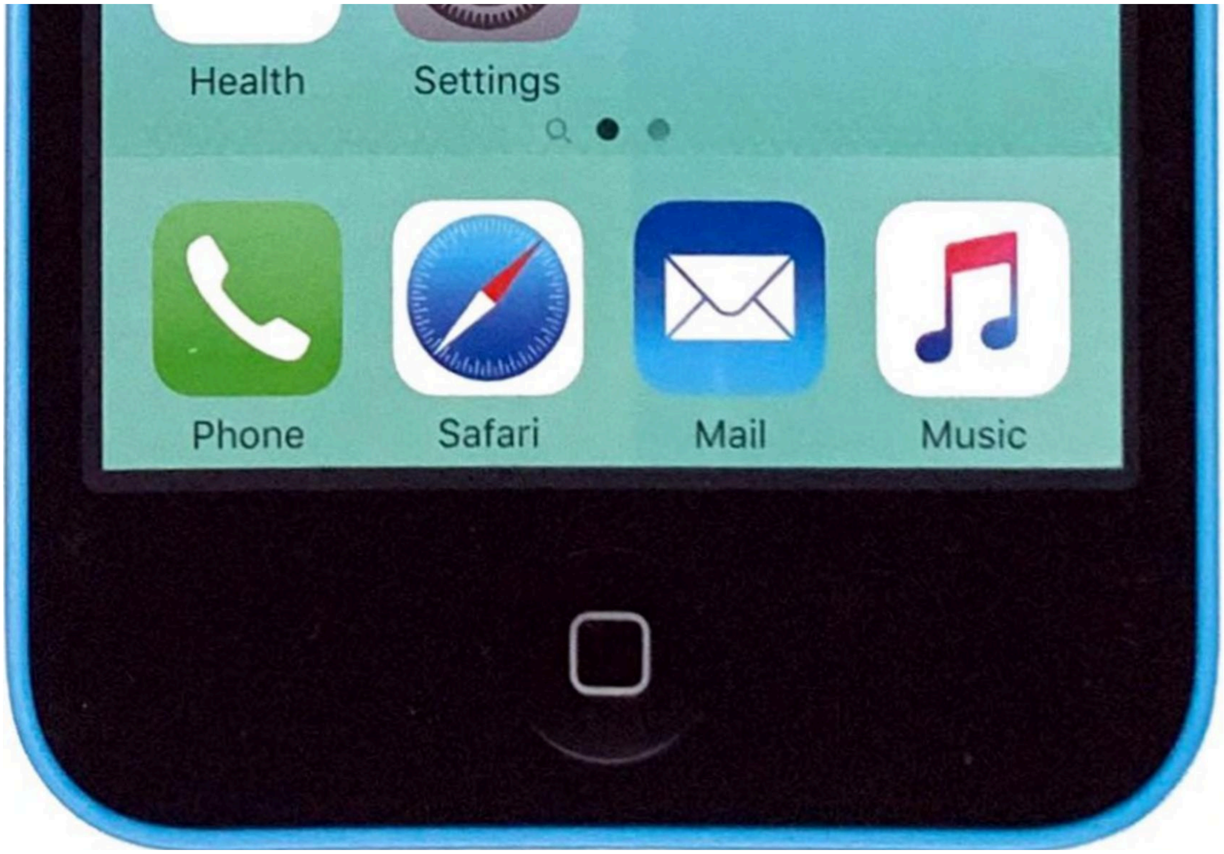
iPhone 5c Case, 2013 248



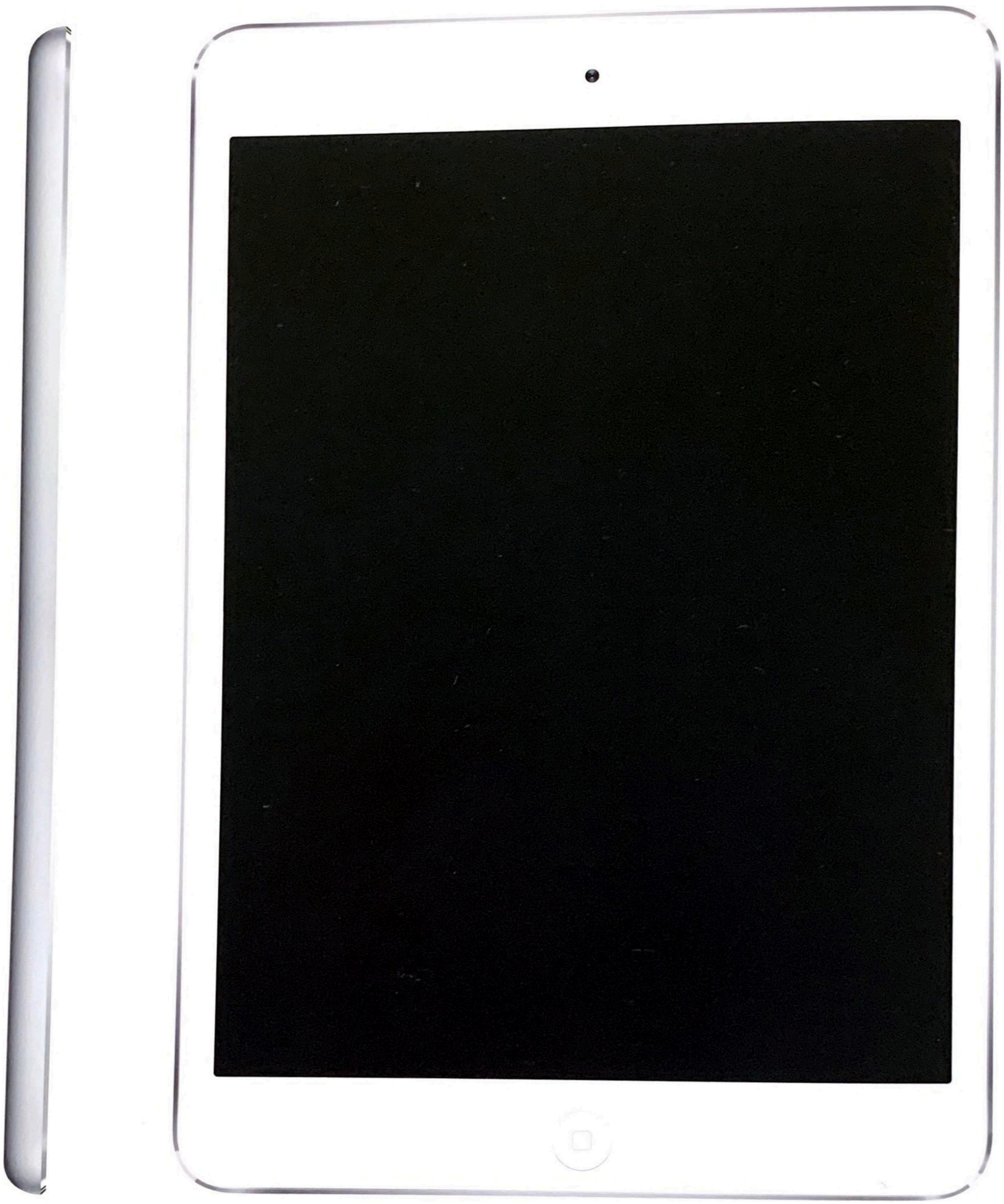


iPhone 5c Wednesday Calendar Photos Weather Clock Videos Wallet Notes Reminders Stocks iTunes Store App Store iBooks News Health Settings Safari Phone Music 249


9:41 AM
100%
Wednesday
9
Messages
Calendar
Photos
Camera
Weather
Clock
Maps
Videos
Wallet
Notes
Reminders
Stocks
iTunes Store
App Store
iBooks
News

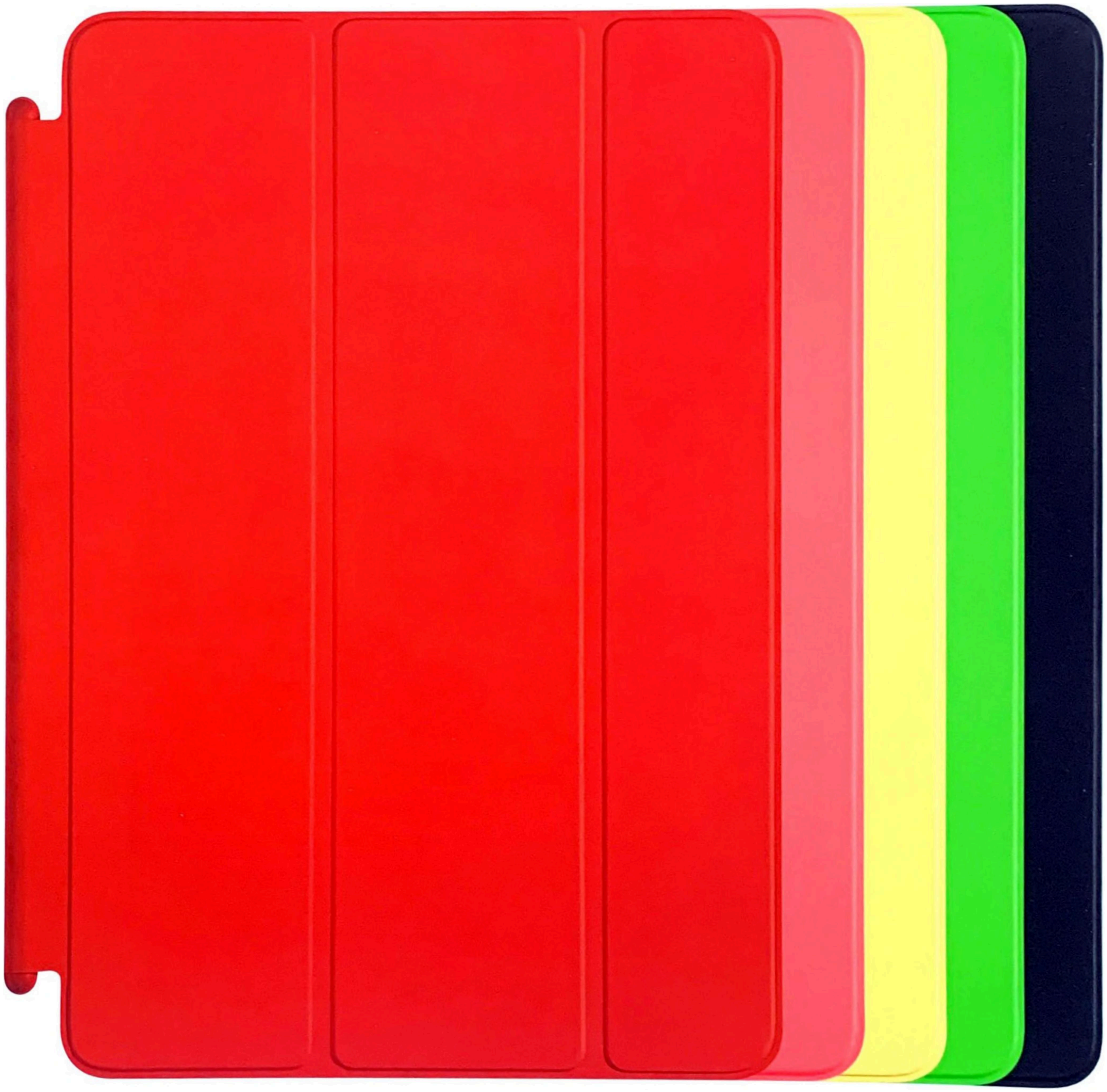

Health
Settings
Phone
Safari
Mail
Music

iPad mini, 2012 250




iPad
Designed by Apple in California Assembled in China
Model A1432 Complies with the Canadian ICES-003 Class B specifications.
FCC ID: BCGA1432 IC: 579C-A1432

iPad mini Smart Cover



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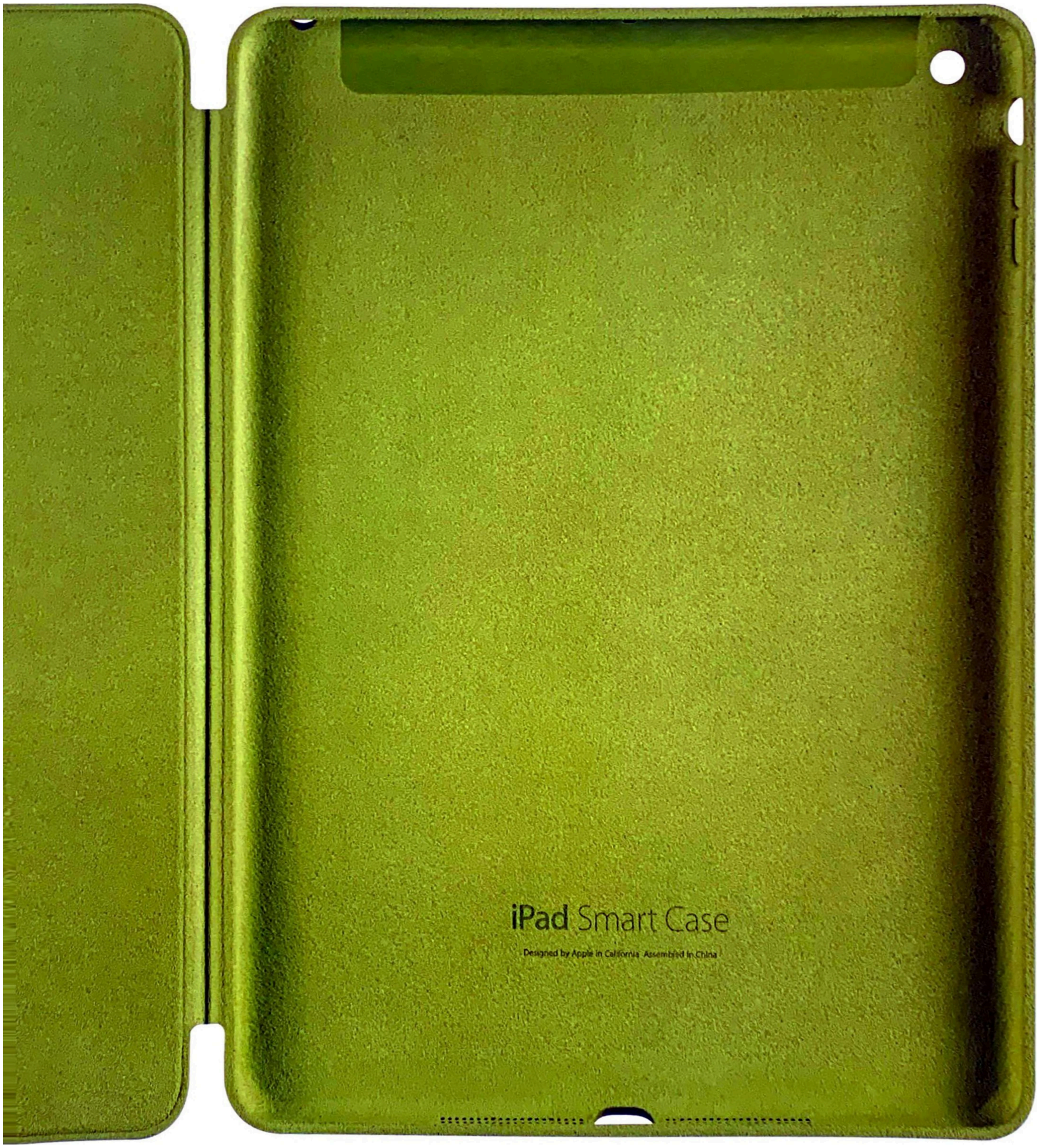
iPad Air Smart Case ■V- 1 ^sl^- ■*' s' •“' i " ' ■1'^ i'-'* ®»5 [■ ' *' 7r' •; * ' @I-.' r# :;x'-^t:sr; *»^sir- ^aeiitSt, -■ . \ ‘^Pi \- ,w’ *.3j 5*'^'i. . ' T »'"'V • ' i>5/' • " ■» , tt-'r.' “v*®" '■;>rji ?fe% KSfxS FlS'^ J'^Wi- V v« laag ^Sl|?-i& -fO® - ^4-- :pHE ffe^t%^ ■, : ^is » .t,-w -r ' . .\^^ . -.A-k-s--!-,' ' . .'vt,^ »U *» ■ •,^*JrfS,:: ,‘.;..;-V :r‘--,. ■ -s ^:\".y ■ .->.• SH^ - ^ ' ’ jAi^ .-^ ! V V: r ' : ^:.i-' V l|W,;.;'>‘ '•’■' ■ • _., \-v/-. ' .^■■■' ’}_' y y • '■•' ;' ■ V ' ■■> ■‘■=^^' \- ’'u'-'i"'" '■_>' ’1 ' r * - * "k'g^jitt^w--'-. • > ' t, " ■’ _^V"'’ ' ■ V ‘ A' ■ .. ‘ -^ * '-.•- “^ ■ ■’^' ' * > ■ : .0 " "r ' 256


iPad Smart Case
Designed by Apple in California Assembled in China

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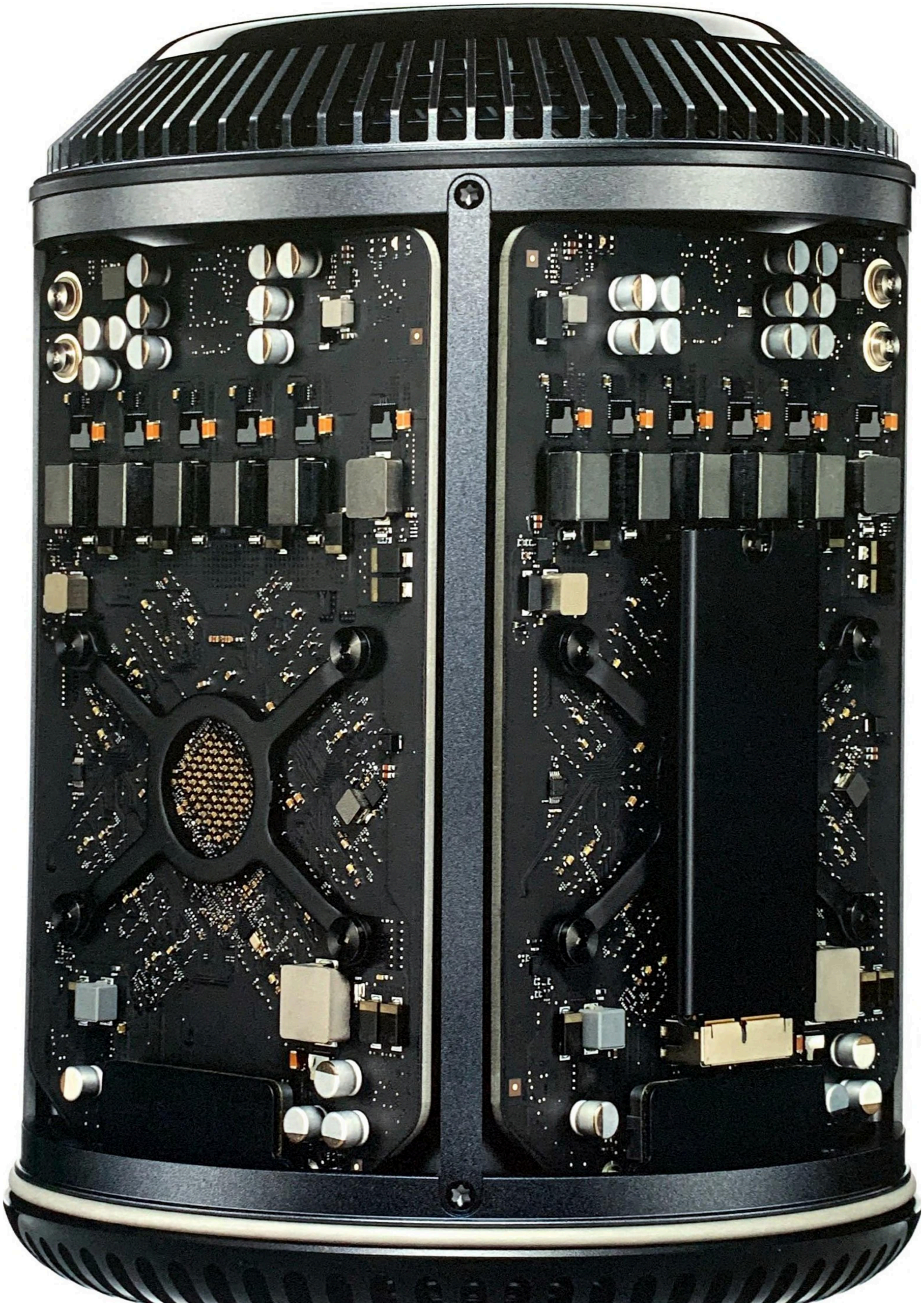
IIU^ 257


HDMI




HDMI
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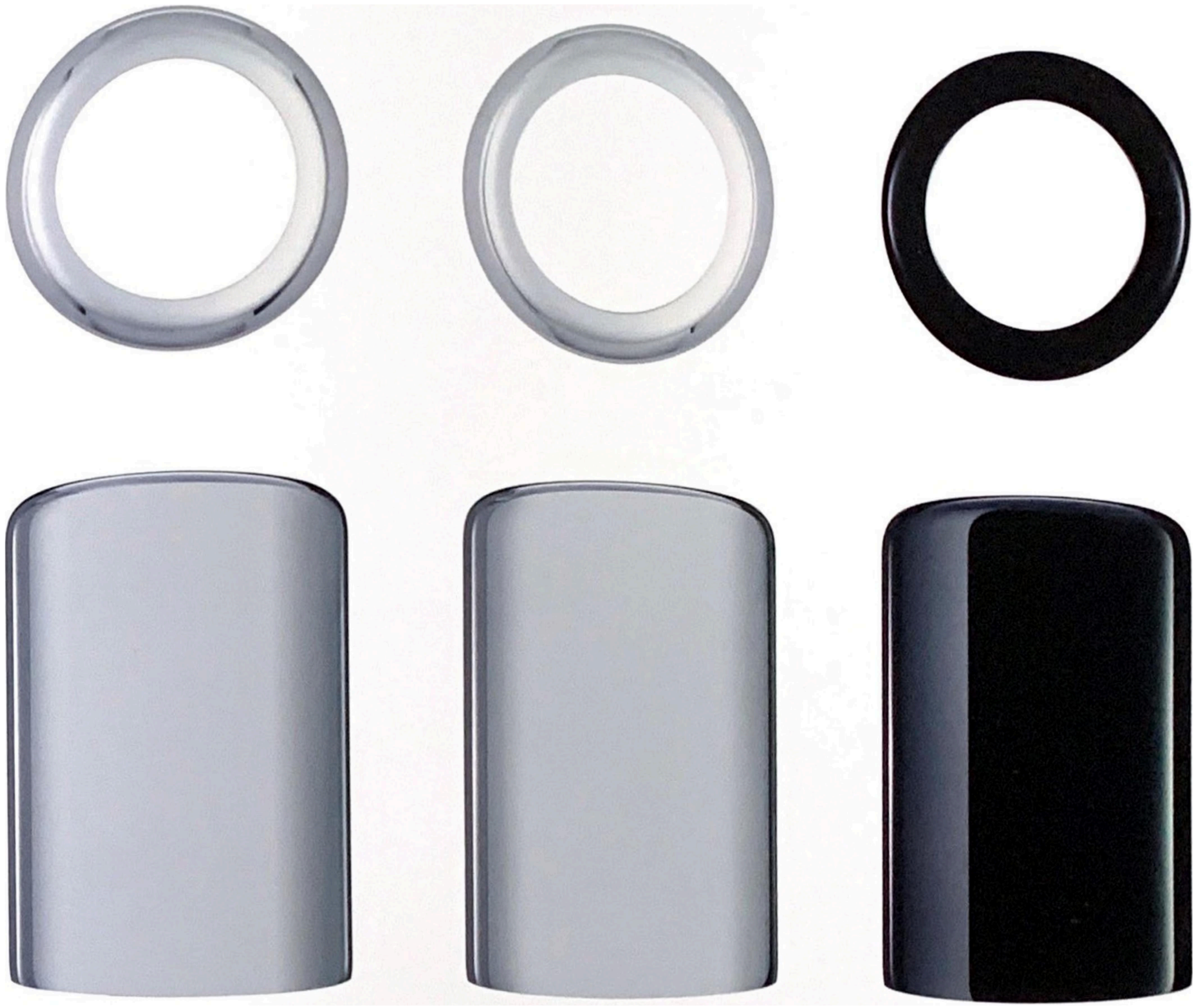

iPhone 6, 2014 266


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iPhone 6 Plus 267


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iPad Air 2, 2014 270

Apple Watch, 2015 273


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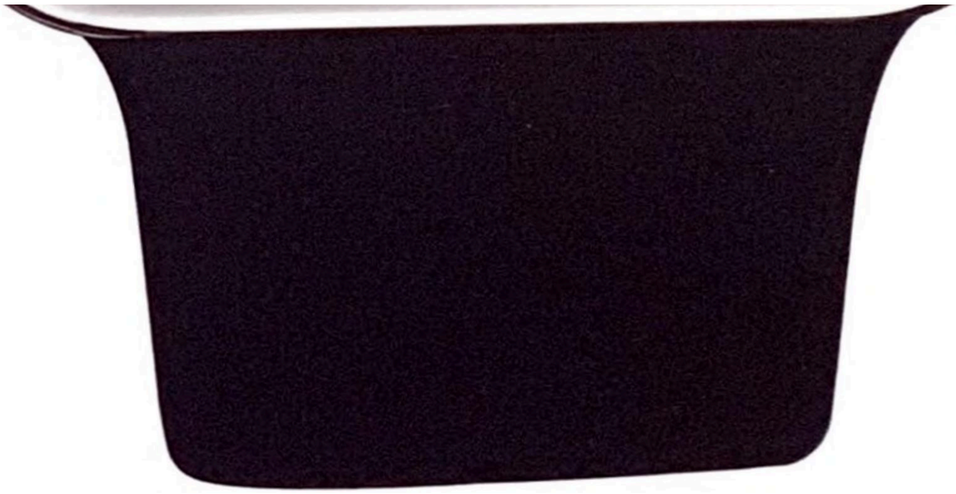
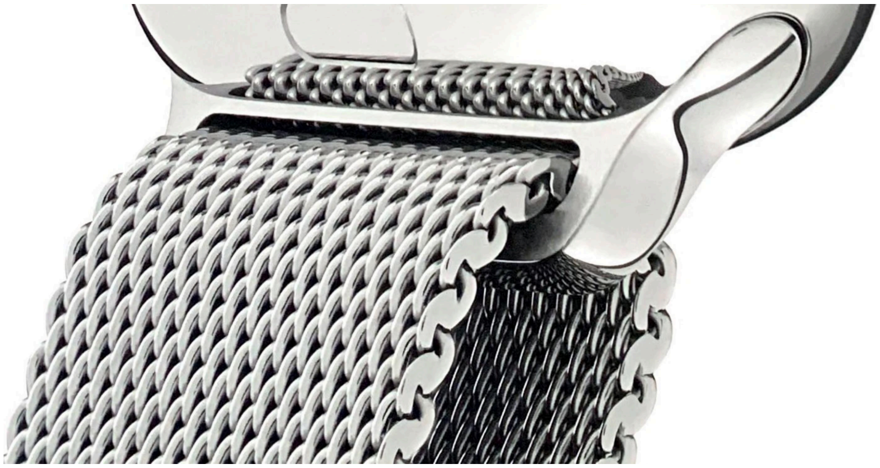
24



f Apple Watch Sport 274

F Apple Watch 276


WATCH • 42MM CASE • 316L STAINLESS STEEL • SAPPHIRE CRYSTAL • CERAMIC BACK • SERIAL



•TAPTIC ENGINE « X _ WARNING: Authorized Service Provider Only. Potential for fire or burning. Do not disasser tiie puncture, crush, heat, or burn. Li-Ion Polymer Battery 3.78V ~ 0.93 Whr 246mAh Model A1579 1ICP5/20/28 Assembled In China 278


TAPTIC
ENGINE
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WARNING: Authorized Service
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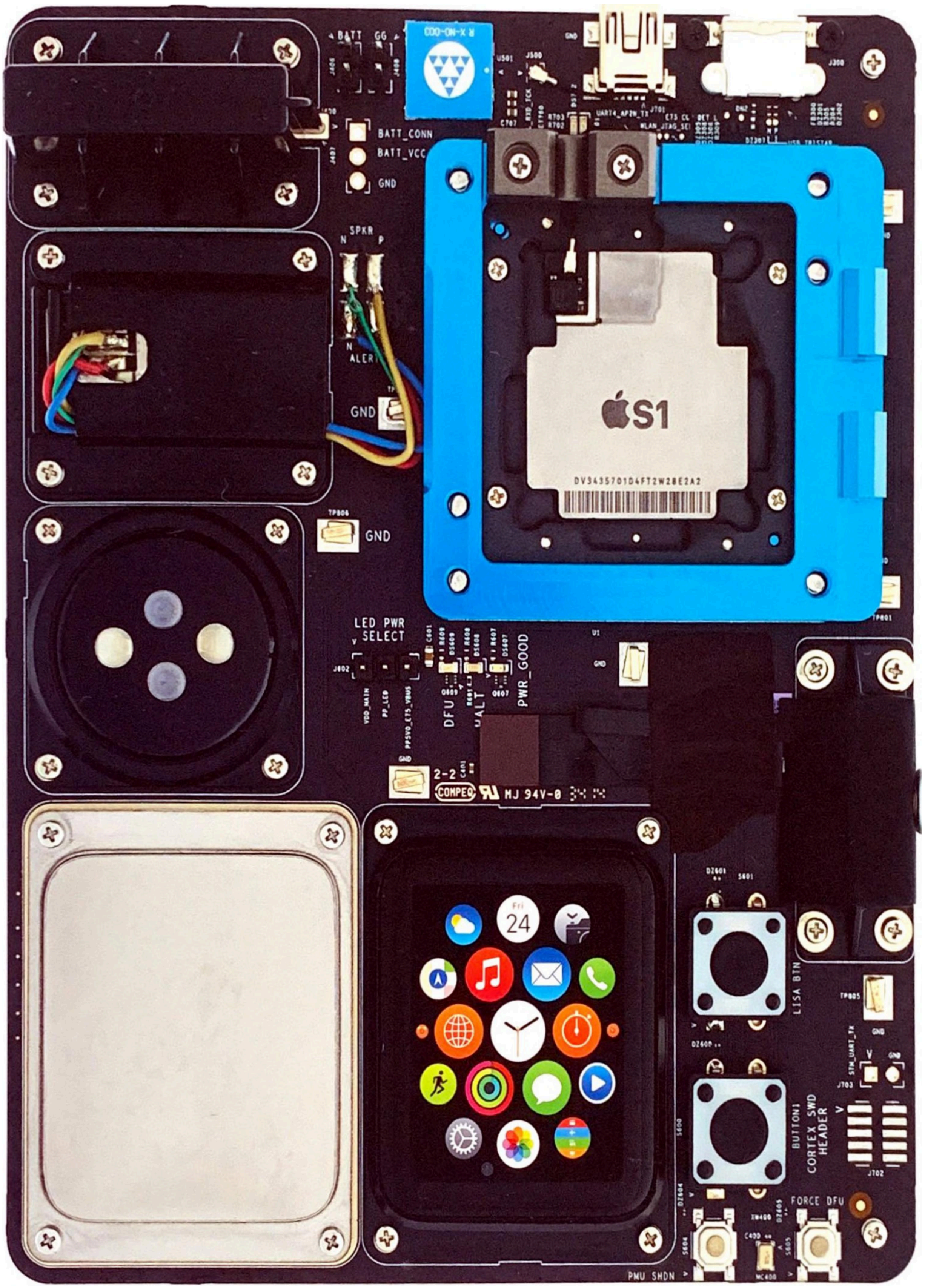
or burning. Do not disassemble,
puncture, crush, heat, or burn.
Li-ion Polymer Battery
3.78V ⎓ 0.93Whr 246mAh
Model A1579 1ICP5/20/28
Assembled in China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LISA BTN
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Apple Watch Edition 284


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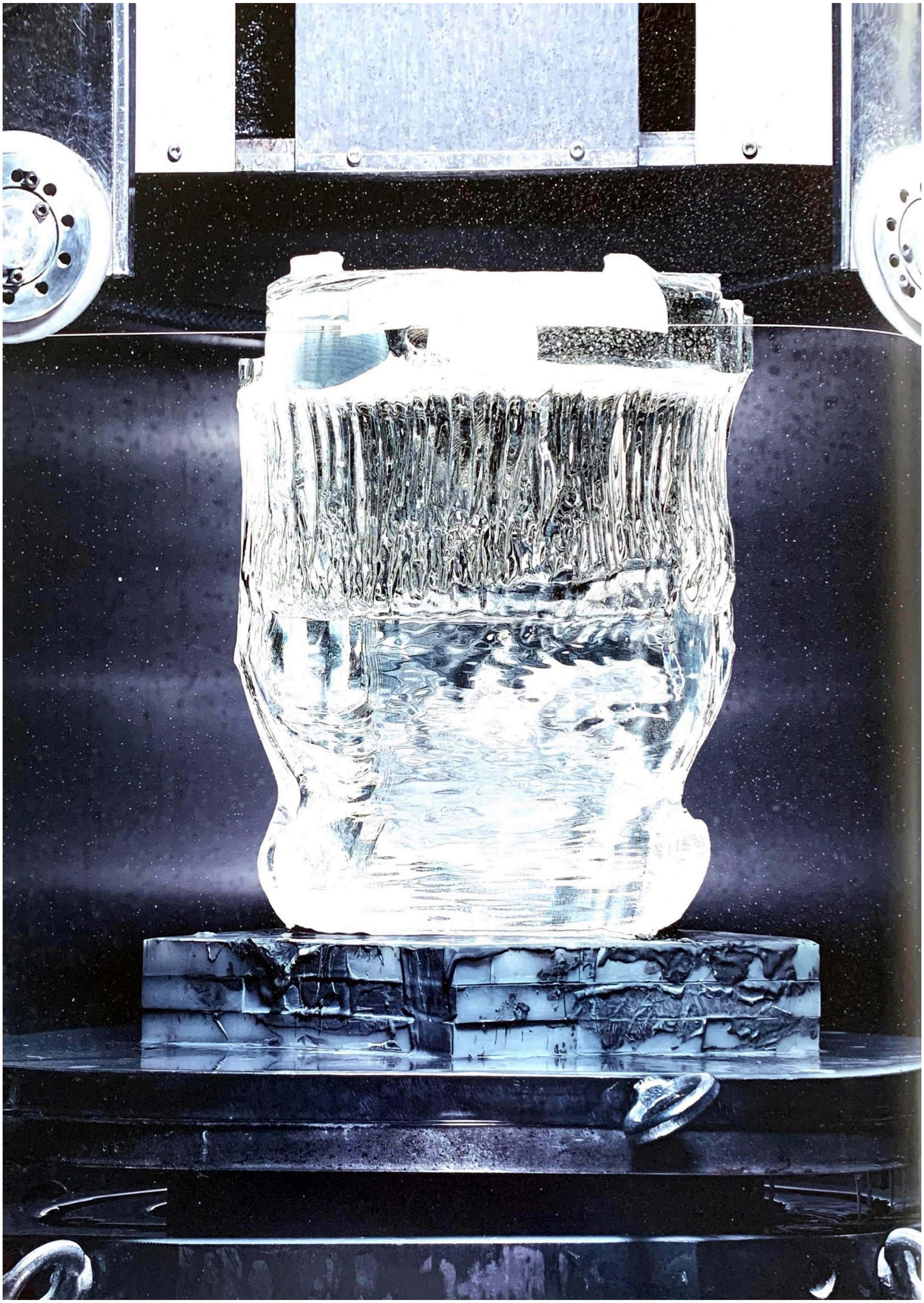

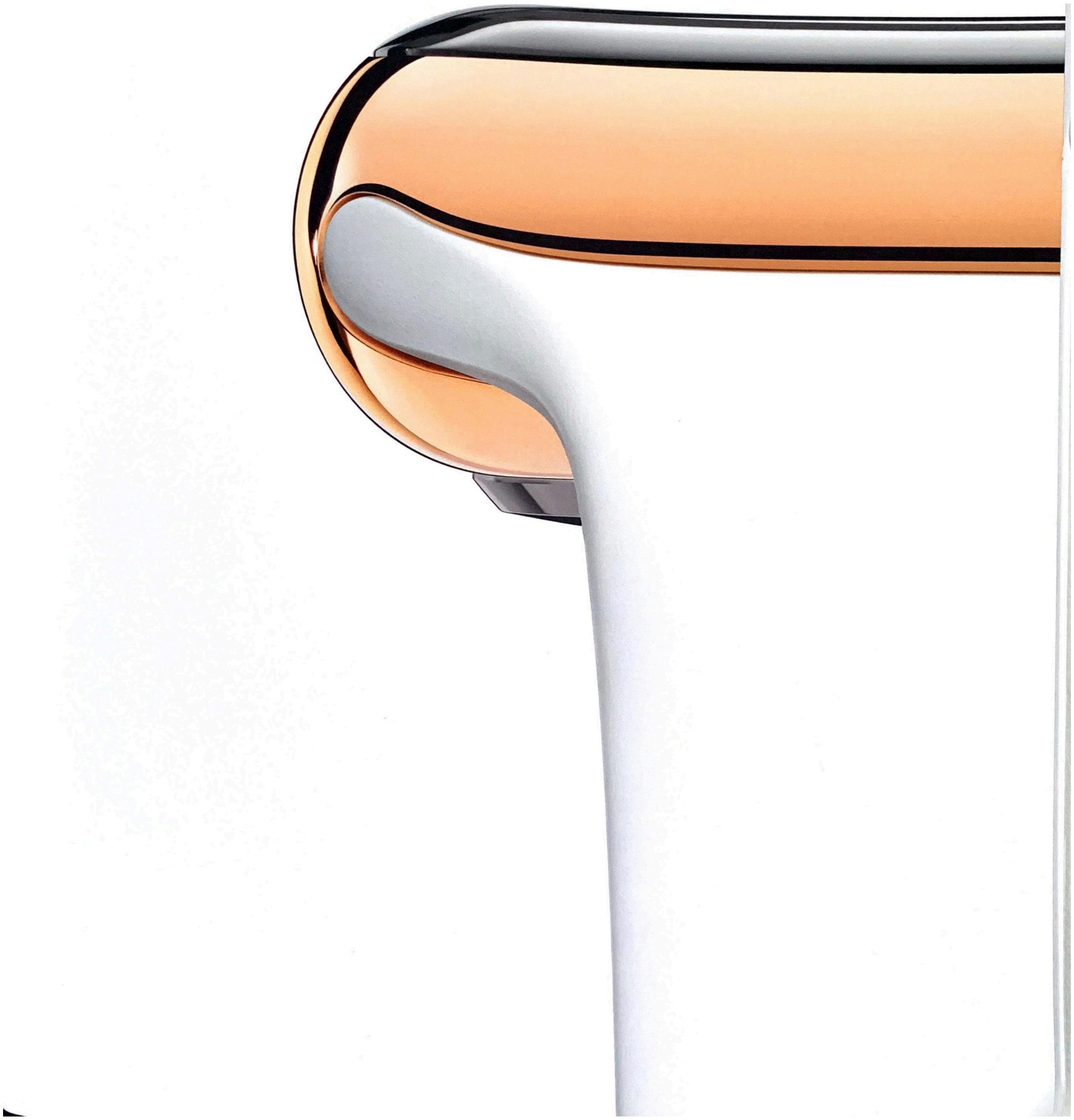


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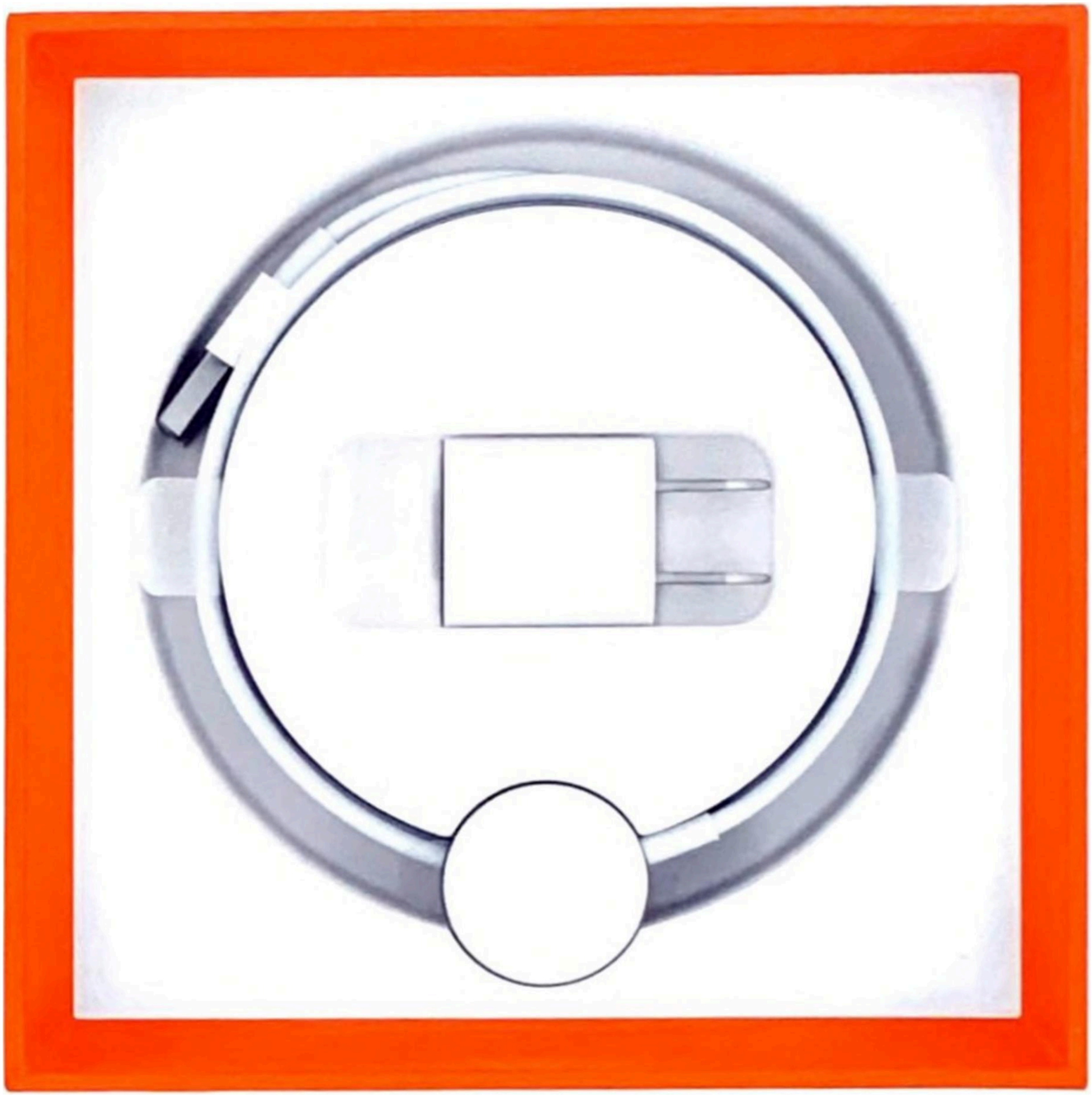
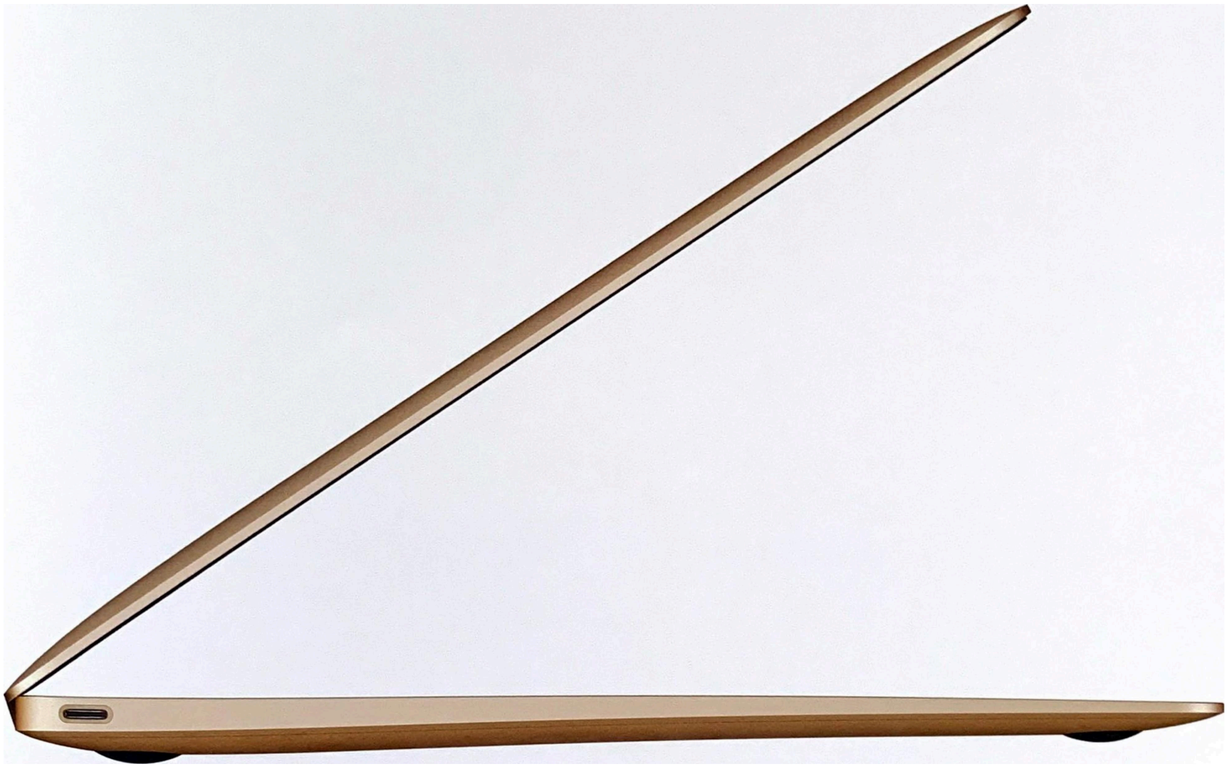



WATCH | HERMÈS


HERMÈS
PARIS

MacBook, 2015 293

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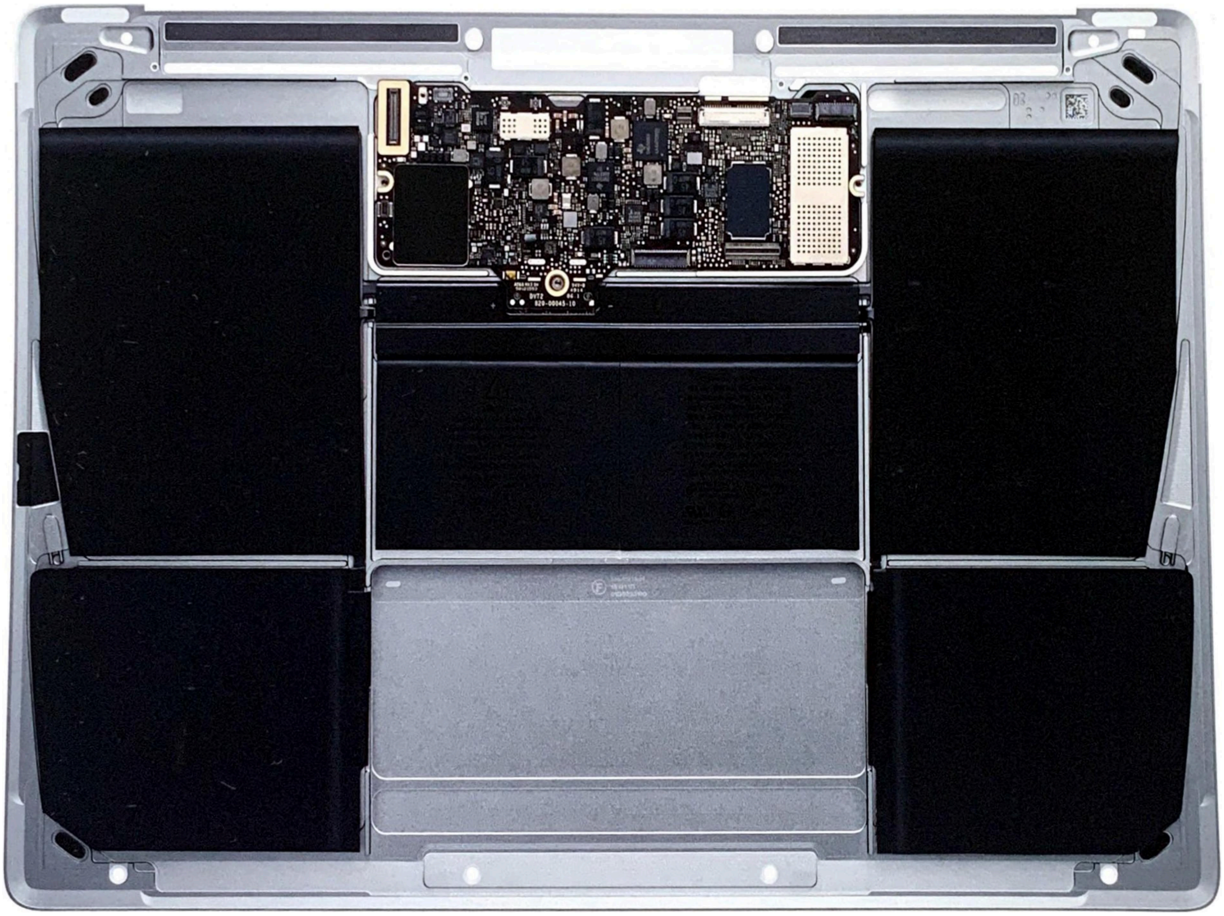

iPad Pro with Smart Keyboard, 2015 297

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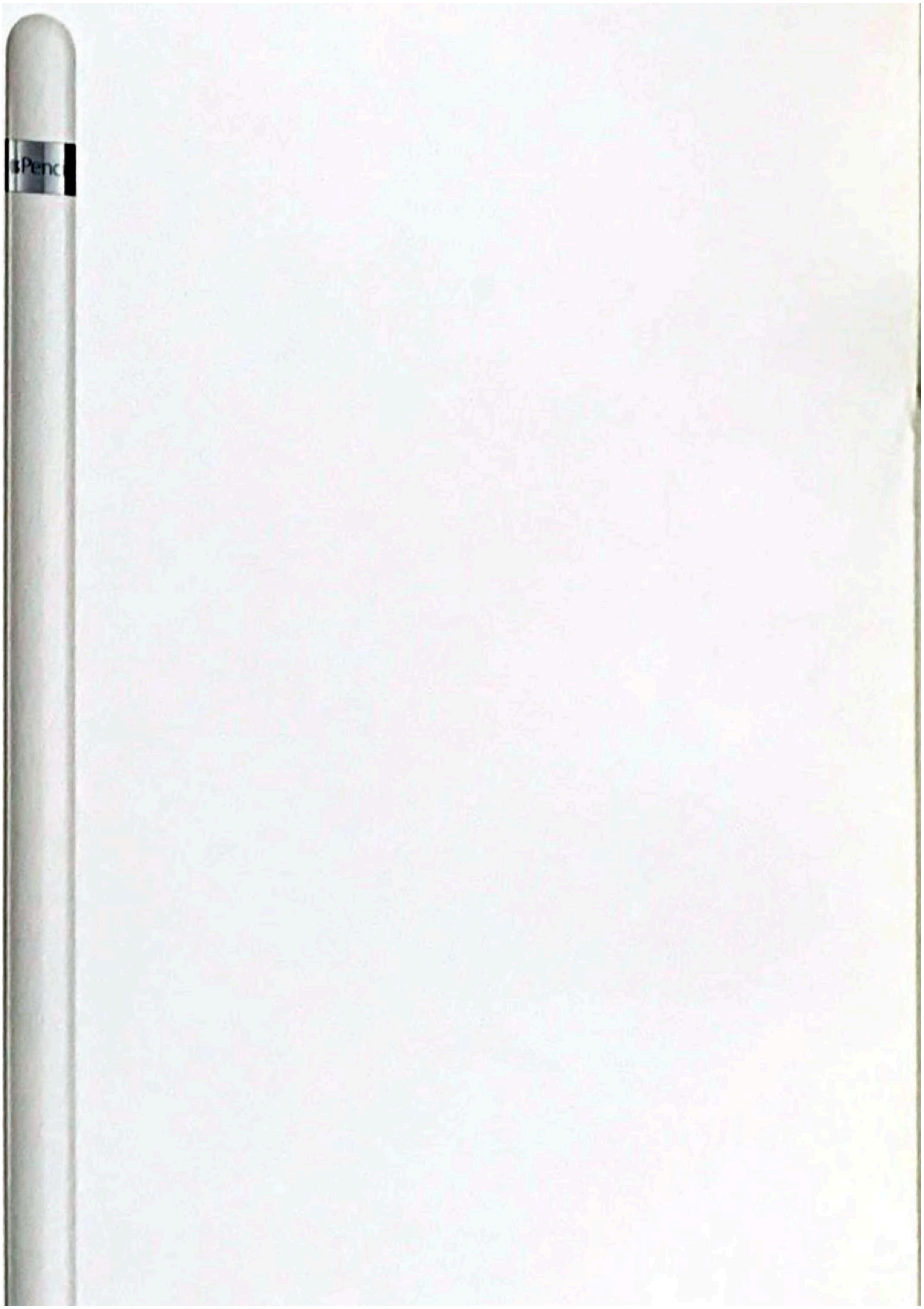

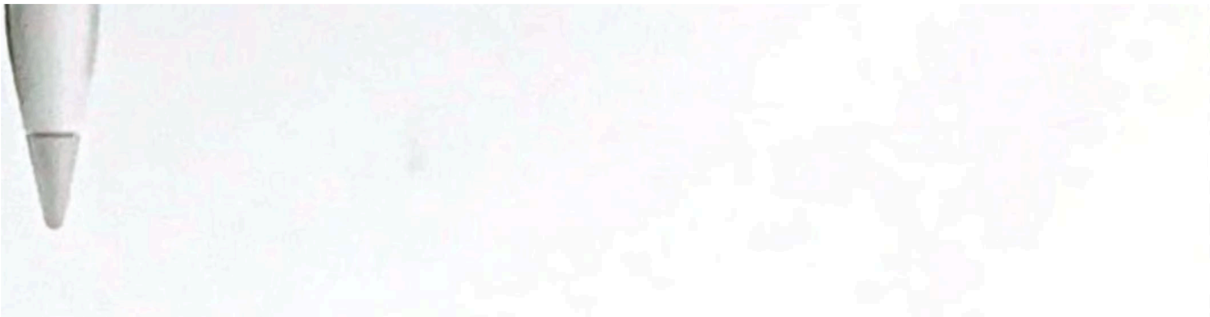

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